Welding Design & Fabrication

ESTABLISHED IN 1930 AS INDUSTRY & WELDING

AUGUST 1959

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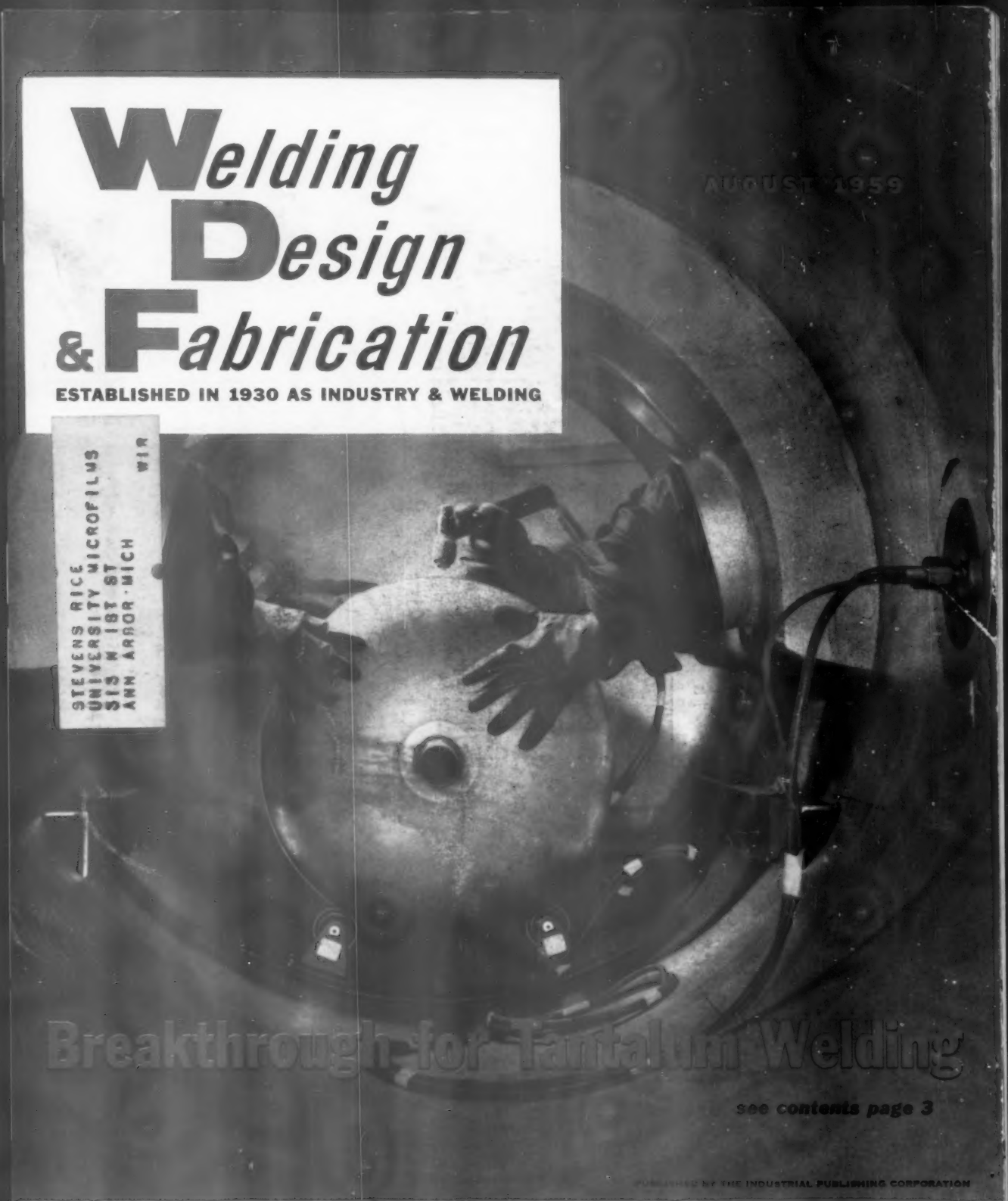


Breakthrough for Tantalum Welding

see contents page 3

PUBLISHED BY THE INDUSTRIAL PUBLISHING CORPORATION

The magazine of welding management, production, and engineering

JACKSON for ARC WELDING

Insulated Copper Alloy Holders have greatest strength, hardness and conductivity. Jackson insulators have highest heat and impact resistance. Choose them where greater duty cycles are called for.

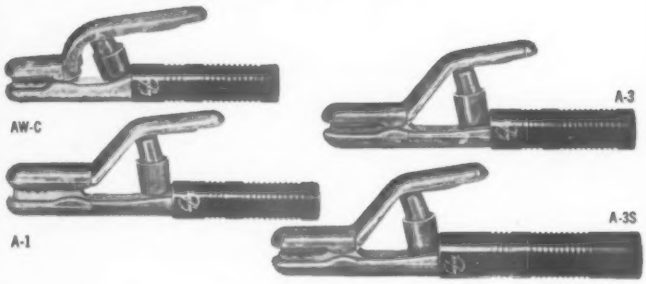
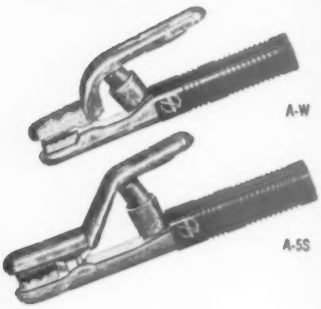


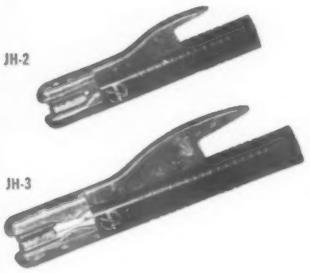
Table shows duty cycles possible with Jackson Insulated Copper Alloy Holders, using electrodes and cables shown.

Holder Class	Model	Electrode	Amps & Cable	Amps & Cable	Duty Cycle
Small	AW-C	7/32"	250—No. 1	300—1/0	50%
Medium	A-1	1/4"	300—1/0	350—2/0	50%
Large	A-3	3/8"	375—2/0	450—3/0	65%
Heavy-Duty	A-3S	3/8"	500—4/0		80%



Featherlight medium class model A-W takes electrodes through 1/4" at 300 amps, weighs 14 oz. Featherlight larger model A-5S has wider tong and wider handle, takes electrodes through 5/16" at 400 amps.

Featherlight Holders have tongs of aluminum alloy, replaceable jaws of high-copper alloy. Excellent all-purpose holders, each within its rated capacity. Cable connection must be made mechanically.



Featherlight and streamlined, small class JH-2 takes electrodes through 5/32" at 200 amps, weighs 9 1/2 oz. Medium class JH-3 takes electrodes through 1/4" at 300 amps.

'Quik-Trik' Cable Connectors 2/0-R and 4/0-R have neoprene rubber insulators with tapered ends to stretch over cable snugly. They lock out moisture and dirt, don't catch against obstructions.

The Jackson
CABLEHITCH

Where welding is done above the level of the machine, Cablehitch suspends the cable near the work area. More cable may be pulled through; it will not slip back.

Cablehitch cuts operator fatigue, increases safety and efficiency, reduces cable wear. In one size to fit welding cables No. 1 through 4/0, gas and air hose 5/16" through 1/8" o.d.

Jackson Ground Clamps give broad metal-to-metal contact. They also fit the hand, go easy on, easy off. Angled socket reduces strain on cable, allows wire fastening for extra support of the cable.

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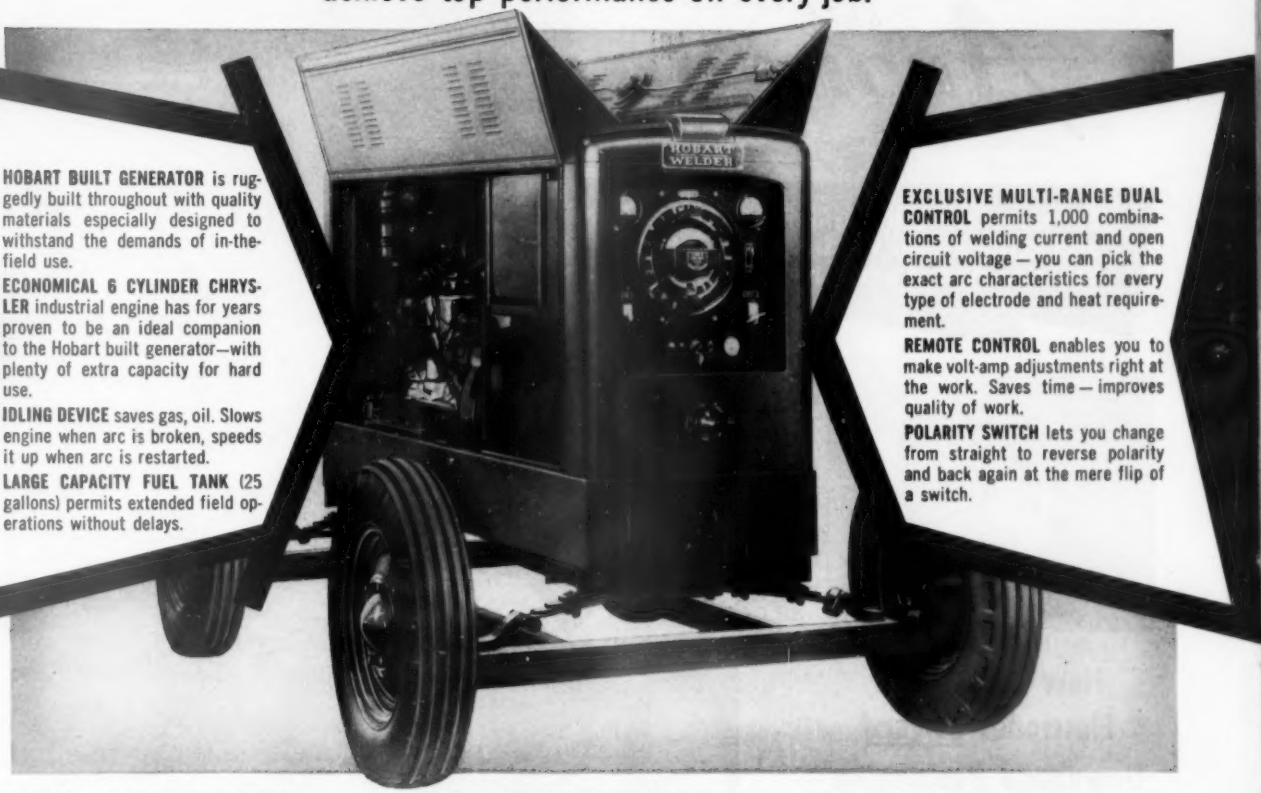

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ECONOMICAL 6 CYLINDER CHRYSLER industrial engine has for years proven to be an ideal companion to the Hobart built generator—with plenty of extra capacity for hard use.

IDLING DEVICE saves gas, oil. Slows engine when arc is broken, speeds it up when arc is restarted.

LARGE CAPACITY FUEL TANK (25 gallons) permits extended field operations without delays.

EXCLUSIVE MULTI-RANGE DUAL CONTROL permits 1,000 combinations of welding current and open circuit voltage — you can pick the exact arc characteristics for every type of electrode and heat requirement.

REMOTE CONTROL enables you to make volt-amp adjustments right at the work. Saves time — improves quality of work.

POLARITY SWITCH lets you change from straight to reverse polarity and back again at the mere flip of a switch.

MORE DEPENDABLE!

Costly delays are eliminated—deadlines are met easily when this rugged Hobart welder is working for you. Superior materials, careful assembly and attention to details have made this welder famous around the world. No wonder it has been nicknamed "The work horse" by the metal working industry. Weldors everywhere have come to know and to depend on Hobart for top performance.

MORE CONTROLLABLE!

Simplified operation and exclusive controls make this Hobart welder easy to use. Special skills or special training isn't necessary to achieve cost cutting performance. Exceptional arc stability is another outstanding characteristic you'll appreciate. All adjustments are easily accessible on a recessed end mounted control panel.

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Whether you use this Hobart welder for construction, maintenance or repair, you'll be amazed at the profitable way it performs.

MORE SIZES! 300, 400, 600 ampere models are available. All have 1 KW DC auxiliary power for running tools, lights, etc. (3 KW DC or 12 KW AC auxiliary power available at slight extra cost.)

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② *Transformers 300 to 500 amps.*

③ *AC/DC Inert Gas Combination*

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④ *Contractor's Special 250 amps. DC*

⑤ *Husky Boy 200 amp. DC*

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New Iron Powder ELECTRODES by Hobart are easy to use and control. They give more weld per electrode and a finely rippled, high quality bead. Available for all types of general purpose use — either AC or DC, straight or reverse polarity. Try them!

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☐ Also more details on:
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☐ Would also like to try out Hobart's new iron powder electrodes.

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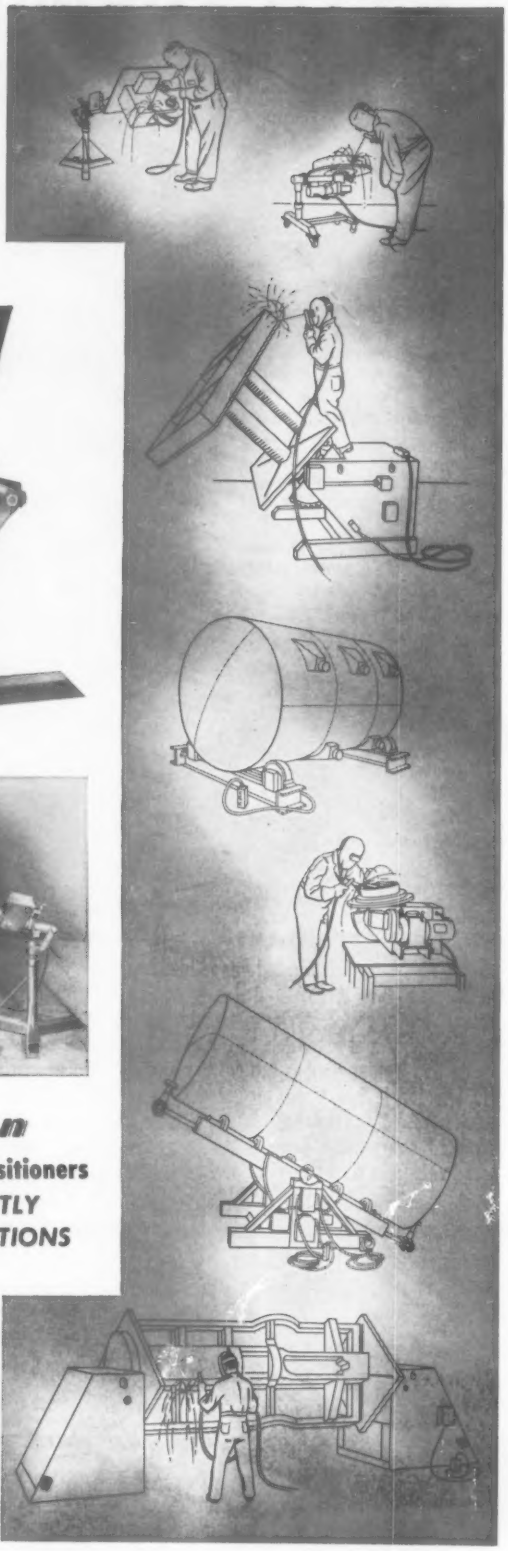
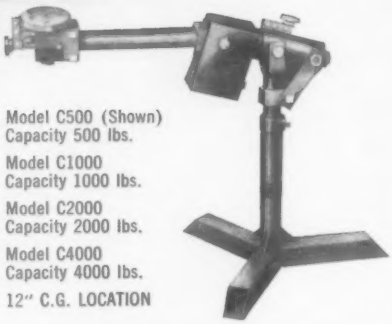
POSITIONEERING *with* Aronson



Aronson UNIVERSAL BALANCE POSITIONERS can REDUCE your WELD TIME by 50% over any other method of positioning!



Model C500 (Shown)
Capacity 500 lbs.

Model C1000
Capacity 1000 lbs.

Model C2000
Capacity 2000 lbs.

Model C4000
Capacity 4000 lbs.

12" C.G. LOCATION

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FULLY AUTOMATIC POSITIONERS
MAGNETIC WELDING CLAMPS

Quality POSITIONERS by **Aronson MACHINE COMPANY**
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WORK WORK

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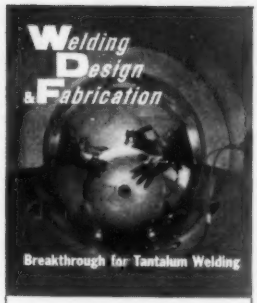
reader's guide to



for August, 1959

COVER: Availability of large size tantalum sheets and improved welding techniques have solved the two major problems which had restricted tantalum-lined pressure vessels to small, laboratory sizes. The 30-gallon pressure vessel being fabricated here is a much larger unit than would have been possible six months ago. And, even larger vessels are already being designed and built.

FEATURES

27 RUSSIA PLANS 40% INCREASE IN AUTOMATIC WELDING BY 1965

The Russians welding journal "Automatic Welding" explains the Soviet's new 7-year plan (1959-1965) and tells how important welding will be to its success.

29 1,500 LB OVERLAY PROTECTS A 7,500-TON PRESS RAM

A report on the planning and procedures used to deposit an aluminum-bronze overlay on a big forging press ram and protect it from sliding friction wear.

30 ARE SPOT AND SEAM WELDS PRACTICAL IN TENSION?

Peel tests say yes. Results of these tests help designers use spot and seam welding to get simpler, lighter and more reliable airborne structures.

32 KNOW YOUR FILLER METALS (Part 2)

The author discusses the relative popularity of the various filler metals; he tells where they are used and gives 10 key factors for proper selection.

34 USE LOW COST HEAT STRAIGHTENING

The author describes this convenient, effective and inexpensive way to eliminate kinks, bulges, bends and distortion from weldments.

36 BREAKTHROUGH FOR TANTALUM WELDING

Significant advances in the techniques of tantalum production and fabrication have made this corrosion-resistant metal available for a wide range of applications.

40 CAN STEEL REPLACE TITANIUM IN CERTAIN MISSILE APPLICATIONS?

This company builds steel containers at one-quarter to one-third the cost of titanium, yet offers weight savings normally associated only with titanium.

42 DESIGN HINTS FOR USING WELDED TUBING

Illustrated are the common arc, gas and brazing methods used to join one tube to another or to join a tube to another metal form.

43 WHAT DESIGNERS SHOULD KNOW ABOUT WELDED STEEL CONSTRUCTION

The author explains that more specific details are required when designing a welded structure than when designing for a riveted or bolted job.

47 NEW "W" JOINT ELIMINATES COSTLY TOOLING

A joint for round-about welding of cylinders, tanks and spheres eliminates costly tooling, lowers labor and rejection costs.

DEPARTMENTS

6 WELDING AT WORK

10 WELDING MANAGEMENT

12 NEWS OF THE INDUSTRY

21 MEN ON THE MOVE

54 USEFUL FREE LITERATURE

60 NEW WELDING PRODUCTS

71 OPPORTUNITIES

72 ADVERTISERS' INDEX

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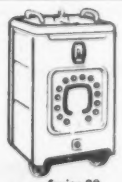
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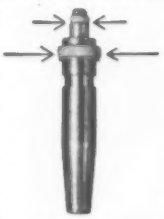
natural gas or propane? **TAKE THE**

FULL SOFT SEAT!

—new Airco 2000 and 2500 Series Hand and Machine Torches



Only Airco gives you full sealing rings of silicone rubber — for high heat resistance, positive durable seal.

Soft seat can withstand rough handling and abuse.

Only 7 tip sizes cover cutting range ⅛" to 12".

Change tips by hand — no wrench.

Triangular stack design of gas tubes in hand torch gives greatest rigidity.

Special oxygen valve permits smooth, ease-on starts required in piercing and cutting.

You've got the *full* soft seat when you use Airco's new premix type 2000 Hand Cutting and 2500 Machine Cutting Torches! Operate with either natural gas, propane, or city gas . . . at low or medium pressure.

Look in the yellow pages of the phone book under "Welding Equipment" for the Authorized Airco Dealer nearest you.

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WELDING AT WORK

to do the job better and cheaper

Coal miners walk on welded electroforged steel grating

NORTHERN WEST VIRGINIA: Installation of open flooring at a large, multi-level coal preparation plant here lets operating personnel supervise operations on several floors at the same time.

Electroforged for strength and permanence, the flooring is Blaw-Knox steel grating. Sections are shown being lined up and welded to provide surface stability.

In addition to increased visibility and permanence, open flooring is easy to maintain and is designed with a roughened twisted bar surface for safe footing. Approximately 75,000 square feet of grating was used for this open floor installation.

U.S. Navy photographs

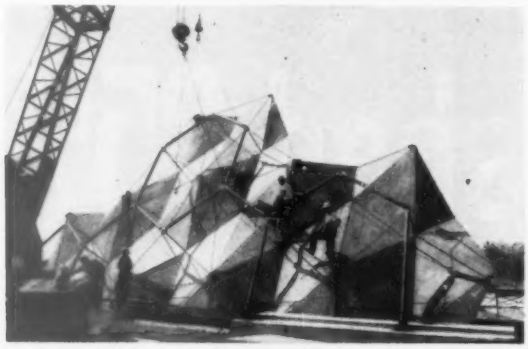
Hard surfacing cuts navy's engine maintenance cost 85%

DETROIT, MICHIGAN: Wall Colmonoy Corp. reports that U. S. Navy overhaul and repair stations are using the company's Sprayweld process and nickel-base hard surfacing alloy to reclaim worn and eroded exhaust valves. The procedure has reduced engine maintenance costs more than 85 percent and has saved the government nearly two million dollars in reclaiming 50,000 valves during the past three years.

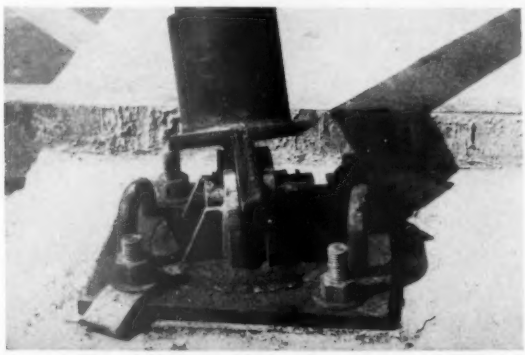
Before surfacing was adopted, exhaust valves had to be scrapped after one service tour. Valves cost $40 each; reclaiming them by surfacing cuts the cost of overhaul to less than six dollars per valve, producing a savings of more than $600 per engine for each overhaul.

OUTGOING SIDE of 383-foot, 120-foot high steel dome. Structure in foreground is a paint tunnel.

HEXAGONAL STEEL PANELS were fabricated on the site in these jigs. Completed panels were stored on location.



SIDE VIEW of lower panels assembled by manual arc welding indicates the degree of panel involution.



TYPICAL ANCHOR PIN (on concrete foundation ring) is arc welded from flame cut steel sections.

Manual arc welding builds revolutionary geodesic dome for railroad car repair shop

BATON ROUGE, LOUISIANA: This beehive-like structure, sometimes known as a geodesic dome, is the revolutionary concept of a modern railroad car repair shop erected here by Union Tank Car Co. It is 384-feet in diameter, 120-feet high, with an unsupported shell made of 321 hexagonal formed 11-gauge sheet steel panels arc welded together. On the outside of these panels is a supporting network of 4-inch pipe and tie rods, interconnected and anchored to the outer foundation ring through welded steel hinge pins and plates.

Basic design of the dome was evolved by R. Buckminster Fuller. It is claimed to have significant advantages in terms of speed of erection, low cost per square foot of enclosed area, freedom from interior obstructions, low upkeep and exceptional wind resistance.

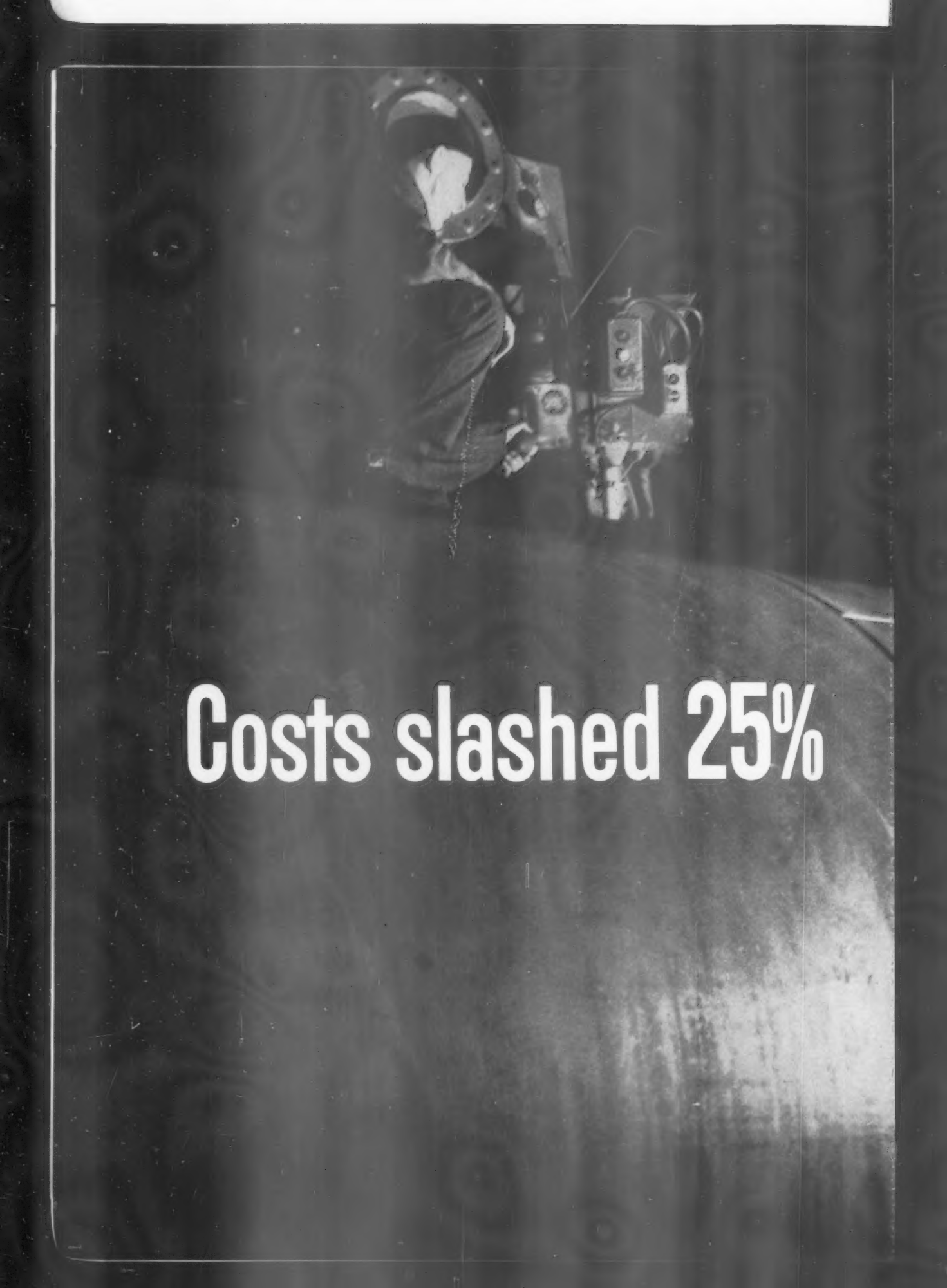
Technically, the dome is designed as a three-dimensional curved truss. It is a unit cell system about 4-feet deep, with the arc welded and involuted steel panels serving as the weathering surface and inner member tension system of the truss. Hexagonal formed panels and their outer pipe and tie rod supports, about 9-feet on a side, are interlocked to extend the dome surface progressively.

Steel panels were fabricated and manually welded directly at the construction site. No scaffolding was required; six long-boom cranes were used. Steelwork amounted to over 500-tons.

The interior is laid out with 36 individual repair track positions in the shape of spokes of a large wheel. Three incoming tracks include one for inspection; three outgoing tracks include one passing through an outside paint tunnel, constructed the same as the dome. At the center of the interior floor is a smaller dome housing a raised control tower from which all parts of the work area may be observed, offices, dining room, reception room and other employee facilities.

Union Tank Car Company's project engineer on the $3 million dome was R. A. Lehr; general contractor was Nichols Construction Company, Baton Rouge.

Accompanying illustrations were furnished by the Lincoln Electric Company, Cleveland.


Costs slashed 25%

Business is booming
at R & R Tank Company!
And now profits are rolling in.

Six months ago, welding costs
were twenty-five to thirty percent higher.
And the profit squeeze was tight.
But no longer!

New production methods
and faster, superior equipment
and electrodes turned the tide.

"How did we accomplish this?
The easiest way possible", says
Mr. Floyd Reinhardt, R & R's president.
"We called in the man who
knows most about welding procedures—
the Lincoln Welding Engineer.

"He suggested some easy changes
which were routine to him, I guess,
but they were news to us."

on tank production

RESULTS: A change in fabricating sequence
plus a switch to "Jetweld 1", iron-powder electrodes
saved 25% through faster welding and easier cleaning.
The three new "Lincolnweld" automatics
increased production and cut the
automatic welding costs by 30%.

Do you want to save time and money
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WELDING MANAGEMENT

watches these developments

SALES AND PROFITS PROSPECTS for the third quarter of 1959 are bright, according to the large majority of business executives interviewed in Dun & Bradstreet's latest poll of businessmen's expectations. Year-to-year sales gains were anticipated by 74 percent of the 1,513 persons replying. Twenty four percent saw no change and two percent expected declines.

The survey was conducted before the opening of labor negotiations in the steel industry and there was no attempt to evaluate the effects of a possible steel strike. However, those interviewed were undoubtedly aware of the possibilities of a sharp decline in steel output in the Summer.

THE AMERICAN WELDING SOCIETY *has resumed its practice of holding a national meeting in the Fall of each year. This year the Society's meeting will take place in Detroit, Michigan, Monday through Thursday, September* 28 *through October* 1. *The Sheraton-Cadillac Hotel has been selected as the Society Headquarters where various technical sessions, including* 48 *technical papers, will be presented.*

A MANUFACTURER of arc welding accessories, Lenco, Inc., gets a plug from American Cynamid Company. A news release from that company explains how Lenco uses Laminac polyester pre-mix molding compound for insulation of electrode holders. The polyester pre-mix also provides high impact strength, particularly important in the tip insulators, as well as good flame and heat resistance and low moisture absorption.

Recognized by their brightly-colored insulation, Lenco's holders have red tips and trigger and yellow handles for instant identification. The colors are molded in with the glass-filled Laminac compound.

NEW ORDERS *for resistance welding machines and equipment received by members of the Resistance Welder Manufacturer's Association in the first five months of this year were* 42 *percent ahead of orders for the first five months of* 1958, *according to a report from Association headquarters.*

Shipments continue to exceed $2 *million per month and are* 15 *percent ahead of the same period in* 1958.

Members reported backlogs of $8½ *million, the highest in nearly two years.*

A ZINC SOLDERING PROCESS for joining aluminum to itself and other metals is expected to broaden the use of the light metal in the refrigeration, automotive, air conditioning and electrical industries, according to the Aluminum Company of America. Exhaustive tests by Alcoa indicate the zinc technique offers the best method for making sound corrosive-resistant soldered joints. Alcoa engineers also reported the process to be superior to brazing for several applications.

When used with special Alcoa joining products, the zinc soldering process is especially suited to bonding thin, complex sections, including heat exchangers of all types.

THE FIRST WOMAN *in the United States to receive a bachelor's degree in welding engineering is a pretty, brown-haired Columbus, Ohio, mother. Mrs. Jane Andre received her degree recently at Ohio State University commencement exercises. She expects to become a research engineer in nondestructive testing; she she also plans to take graduate work.*

THREE GRADES OF TITANIUM have been approved for welded pressure vessels by the Boiler and Pressure Vessel Committee of the American Society of Mechanical Engineers. In the past, special approval was required for each unit if the vessel required code approval; but now that titanium has assumed the status of a fully approved construction material, code stamped titanium equipment should present no problem.

The ASME-approved grades 1, 2 and 3 of the ASTM specification B265-58T, which are all unalloyedgrades of titanium. Grade 1 is a high purity, low strength grade which is normally specified when corrosion resistance and extremely high ductility are the prime requirements and strength is of little consequence. Grade 2 and Grade 3 correspond to Crucible's standard grades A-40 and A-55, respectively.

It is believed that the next step will be the submission of a case for the various weldable titanium alloys. These alloys have almost twice the strength of A-55, the highest strength unalloyed grade approved, and will permit the economic design of titanium equipment for higher temperatures and pressures while retaining the excellent corrosion resistance of the unalloyed grades.

THE FIRST LARGE VOLUME *application of aluminum by the railroad industry will be* 1205 *aluminum railroad cars to be built for the Southern Railway System. According to David P. Reynolds, executive vice president, Reynolds Aluminum Company,* 455 *cars will be covered hopper cars built by Magor Car Corporation, Clifton, N. J., and* 750 *will be gondola cars manufactured by Pullman-Standard, a division of Pullman, Inc., Bessemer, Ala.*

Reynolds will supply 18,700,000 *pounds of aluminum plate and extrusions. The order involves* 13,800,000 *pounds of aluminum plate,* 4,400,000 *pounds of extrusions and* 500,000 *pounds of miscellaneous items. It is expected that the entire order will be delivered and fabricated over a* 4*-month period.*

save!

Push the button—and save up to 10% on oxygen costs, up to 30% on fuel gas costs . . . with SMITH'S money-saving push button gas control unit! Two additional advantages: it saves on labor costs—16% in a typical case history . . . also improves cutting quality by reducing burnover; improves welding quality by reducing pinholes and slag inclusions and gives better puddle control. SMITH'S gas control unit instantly reduces the high pre-heat flame you need to start many cutting, welding, silver soldering, production brazing, and heating operations to the lower flame you need to complete them. Makes an ideal shut-off valve for inert gas welding, heavy heating and flame hardening equipment. It works on a solenoid-operated valve, plugs into any 110 volt outlet. Use with as many as 8 machine torches (pays for itself over and over again). Available with either hand or foot operated remote control for maximum convenience. See your welding supply distributor, or write:

PUSH-BUTTON GAS CONTROL

SMITH WELDING EQUIPMENT CORPORATION

2621 Fourth Street S. E.,
Minneapolis 14, Minn.

For More Information Circle No. 55 on Reader Service Card.

12 JAPANESE inspect automated equipment at Progressive Welder Sales Company.

BOLIVIAN DISTRIBUTOR and PARAGUAYAN OPERATORS keep up-to-date on latest in arc welding equipment, materials and techniques by visiting Hobart Brothers Co.

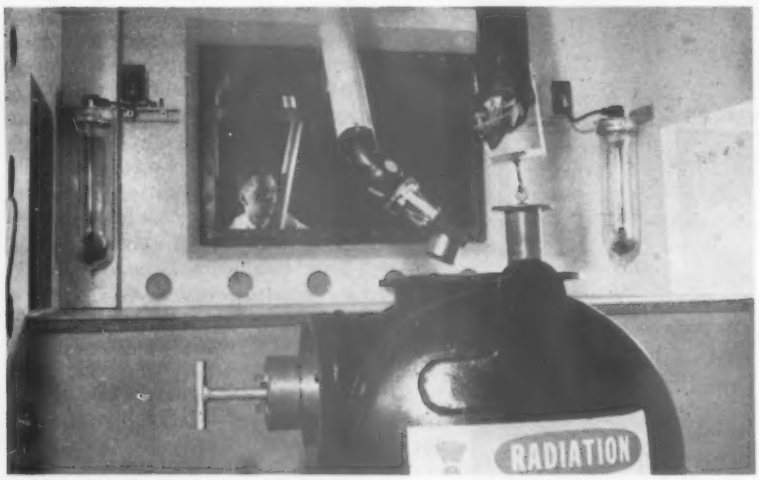
Americans spread welding know-how throughout the world

AMERICAN WELDING EXPERTS continue to spread the story of this country's advanced welding techniques and equipment to the rest of the world. The examples above are typical of the educational functions performed by American manufacturers of welding equipment, supplies and accessories.

Above, left: Twelve Japanese welding experts visit the Progressive Welder sales Company's Warren Alloy Plant at Pontiac, Michigan. Members of Japan's Small Business Welding Specialists Study Team, these men were interested in Progressive's automated welding equipment for use in the automotive industry. They were particularly interested in an automatic turntable-type multi-projection welder designed for welding studs to the reinforcement plates of instrument panel brackets.

Above, center: Alberto M. Vazquez (center), manager of Equipo Petrolero Ltda., La Paz, Bolivia, distributors of Hobart welding equipment in that country, visits with W. H. Hobart, Jr. (left) and G. R. Whitlow, Hobart's export manager (right), at Troy, Ohio.

Above, right: Two trainees from Paraguay received four weeks welding training at Hobart Technical School, Troy, Ohio. Julio R. Salgueiro (left) and John Janzen were sponsored by the U. S. Point IV Operations Mission in Paraguay and the International Cooperation Administration.



SAFELY SHIELDED, technician controls master-slave manipulators to load a highly radioactive isotope charge into a heavy, lead container.

Picker X-Ray Studies New Radiation Uses

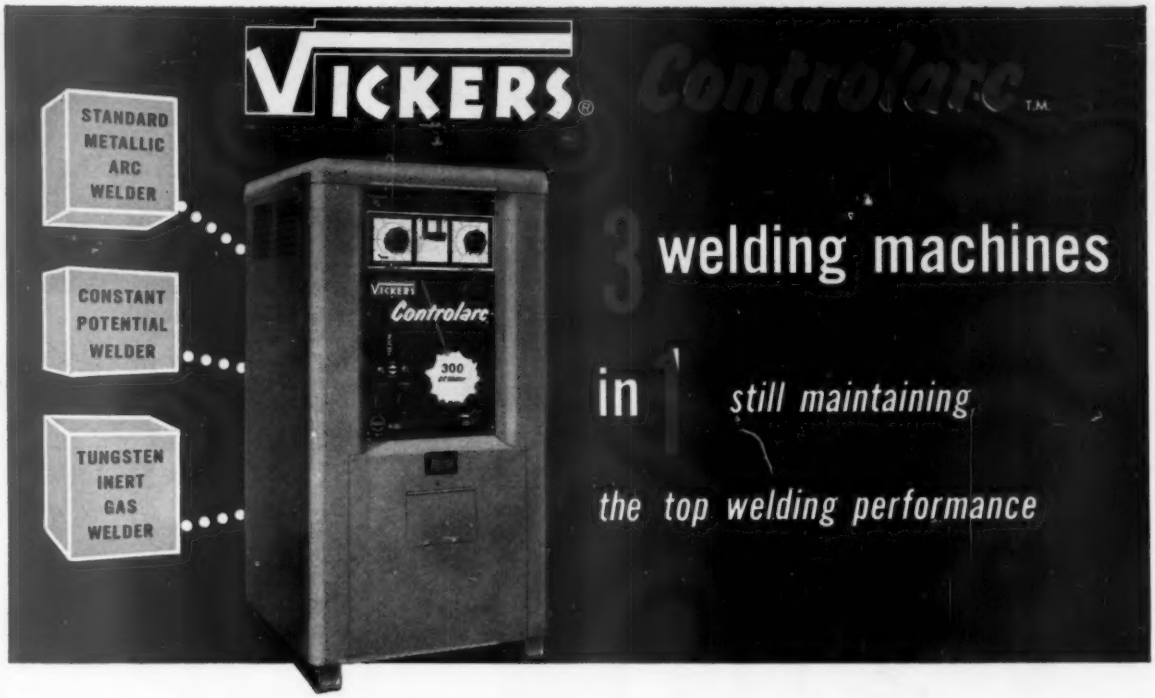
CLEVELAND, OHIO: The Research Center built here by Picker X-Ray Corporation will be used to probe into new uses for radiation and for refining techniques in existing uses of gamma and X-rays. The laboratory is capable of encapsulating isotope "sources" equal in radiation power to 1,000,000 grams of pure radium. The Research Center is the nation's largest non-government installation for processing radioisotopes.

Arabian Oil Firm Checks Piping With Iridium 192

PHILADELPHIA, PA.: An Iriditron Model 20 Radiography machine containing 50 curies of the radioactive isotope iridium 192 has been sold to Richardson X-ray Service, Alhambra, California by Nuclear Systems, a Division of The Budd Company.

Richardson will operate the radiography machine on a contract basis for the Arabian American Oil Company. Another Iriditron Model 20 is already in use at Aramco's Saudi Arabian facilities.

more news on page 14



In this versatile welder, Vickers has combined:

1. Standard Arc Welding
2. Constant Potential Welding
3. Tungsten Inert Gas Welding

in ONE Outstanding Machine.

The price is less than half of separate machines!

And this combination has been achieved *with no loss of complete welding performance*. Standard or CP operation is superior to operation of competitive individual machines. Now you can do almost any welding job from this single source, without an expensive investment in multiple machines.

NEW—From Vickers... 500 Amp. Constant Potential Welder

Can be paralleled to give any current for any semi-automatic or automatic job requiring direct current constant potential power.

- Built in remote control receptacle.
- Voltage adjustable (stepless) from approx. 13 to 36 volts.
- Slightly falling output slope—may be adjusted internally to flat or slightly rising for special conditions.
- Hot start adjustable. May be internally adjusted to any desirable degree.
- High speed of response.
- No moving parts.
- Quickly paralleled for high output requirements.

■ Contact our nearest welder dealer for prices or call factory!

■ Write for special descriptive bulletins 7136-1 and 7146-1.

EPA 7110-8

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
ELECTRIC PRODUCTS DIVISION
1855 LOCUST STREET • SAINT LOUIS 3, MISSOURI

For More Information Circle No. 65 on Reader Service Card.

ATLAS | WIDE - BLADE TOMAHAWKS

WORLDS LEADING WELD CLEANING TOOLS

Handle raised for a quick grip!

THE *NEW* ATLAS *"EASY-GRIP"!*

WITH "WIDE BLADE" THAT SPEEDS THE JOB

This is our economy tool—yet it has all these famous Atlas features: (1) Forged head of chisel steel with 18% wider blade for faster work with less effort. (2) Head can't come off or turn on shaft (3) One piece steel shaft and grip that can't burn or splinter and lasts as long as the head . . . You'll like both the "feel" and balance of this husky, quality Atlas Tomahawk and you'll like the price, too! It is available in three models: cross chisel and cone, chisel and cross chisel, chisel and cone. At the price, you can own the set of three and be prepared for any job that comes along.

Tough as they come!

33 MODELS

Each Atlas tool is made as well as we know how. Ask your welding supply dealer to show you the complete line.

ATLAS
WELDING ACCESSORIES
INCORPORATED
707 E. LEWISTON
FERNDALE 20, MICH.

For More Information Circle No. 11 on Reader Service Card.

24 HOUR STEAM ROOM TEST at a controlled temperature of 125°F and 90 percent relative humidity is made to check the insulation on this Hobart 300 amp gasoline engine-driven welder. This is only one of the many tests that all arc welding machines must pass to meet rigid military specifications.

NCG Announces Three Oxygen Supply Plants

CHICAGO, ILLINOIS: National Cylinder Gas Division of Chemetron Corporation has placed in operation a new transfilling plant at Odessa, Texas. It is constructing similar plants at Sagniaw, Mich., and Buffalo, N. Y., to serve those areas with liquid and gaseous oxygen.

Zero Buys West's Largest Welding Company

BURBANK, CALIFORNIA: Zero Manufacturing Co. has announced the purchase of Electronic Welding Company, also of Burbank. Electronic Welding is reported to be the largest diversified commercial welding facility on the West coast.

Linde Builds Liquid Hydrogen Plant

TORRANCE, CALIFORNIA: Linde Company, Division of Union Carbide Corp., will build a liquid hydrogen producing plant here, according to a recent announcement.

Arcos New England Office Is Moved

NEEDHAM HEIGHTS, MASS.: The New England District Office of Arcos Corp. has been moved to 45 Kearney Road here. It was formerly located at 28 Travis Street, Boston.

more news on page 16

Way ahead in VISION... Way ahead in VENTILATION

NEW!

AO "Kool-Vent" Face Shield (No. 283)

Ever see a face shield *like this?*

It's a real "natural" — never before have you seen a shield like it with protection, vision and comfort combined.

There's no screen before the eyes to impede vision but plenty of 24 mesh screen elsewhere for good ventilation. The clear acetate window permits unobstructed vision. Workers can do a better job. No wonder this new AO Face Shield has been enthusiastically received wherever it has been shown. It is available with clear, green or aluminized windows.

Recommended for hot operations or *any* operation where a man wants the best combination he can get of vision and ventilation.

Back headband is fiber, adjustable, fits lower head snugly, comfortably. The long band slides within a fiber sleeve — permits easy nut adjustment for head size and prevents hair pulling.

AO H-3 Face Shield
— Same as AO #283 except entire window is acetate.

AO H-1 Face Shield For operations where no standard spark deflector or forehead guard is required. Adjustable elastic headband may be worn low on head for extra comfort. Standard leather sweatband and window, snap-on type.

FEATURES — AO 283 and H-Series Face Shields

- Slotted window permits expansion and contraction. Heat won't warp or distort.
- Most models with deep spark deflector.
- All vulcanized fiber parts of rugged construction (specification thickness).
- Windows set out extra inch for clearance and ventilation.
- Genuine leather sweatband, easily removed for sterilizing.
- Automatic friction joints. No turning or tightening.
- Jointed rear headgear for better fit and anchorage.
- Easy rear adjustment to head size.

Always insist on ® *Trademarked Safety Products*

American Optical
COMPANY
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASSACHUSETTS
Safety Service Centers in Principal Cities

YOUR NEAREST AO SAFETY PRODUCTS REPRESENTATIVE CAN SUPPLY YOU

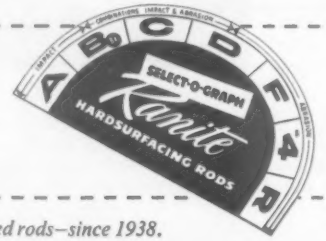
For More Information Circle No. 6 on Reader Service Card.

Ranite Hardsurfacing Rods are So Easy to Use they've earned the title, "The Weldor's Rod"

NINE ADVANTAGES combine to make Ranite metallic-coated rods easiest to use:

1. Operation is equally good on AC and DC machines.
2. Application is practical in *all positions*—including vertical and overhead!
3. Arc is very quiet and stable.
4. Loss from splatter is eliminated.
5. There is no slag to remove.
6. Clear welding vision is maintained.
7. Arc can be re-struck instantly, if broken, because of metallic coating.
8. Rapid deposition rate gets the work done fast.
9. Latitude is very broad—just five Ranite rods—A, BX, C, D and No. 4—handle the *great majority* of all jobs—makes selection quick and easy! (Other Ranite rods available to meet every requirement.)

GET FREE Ranite Select-O-Graph Guide—shirt pocket size—shows best rod to meet any wear condition. Ask your Ranite representative or write direct.



Originators and pioneers of metallic-coated rods—since 1938.

Ranite
WELDORS' NO. 1 CHOICE FOR HARDSURFACING

RANKIN MANUFACTURING CO.
616 So. Marengo Ave., P. O. Box 631
Alhambra, Calif.

For More Information Circle No. 49 on Reader Service Card.

LESTER DAVIS (left) president of Davis Welding Products, Inc., Portland, Oregon, turns a valve to start pumping liquid oxygen into his company's new 1,500,000 cubic foot storage tank. Looking on are Chamber of Commerce Director Carvel Linden (center) and C. S. Richmond, manager of Linde Company's Pacific Northwest District.

Contour Uses One Trade Mark For All Products

COMPTON, CALIFORNIA: In order to avoid confusion and make possible quick identification Contour Sales Corp. has registered all four of its products under the "Curv-O-Mark" trade name. The company's four patented welding aids had all been marketed under a different name.

NCG Opens New Charleston Office

CHARLESTON HEIGHTS, S. C., Establishment of a new sales office and warehouse at 2045 Meeting St. has been announced by the National Cylinder Gas Division of Chemetron Corp.

COMING EVENTS

September 24-25: Central Zone Meeting, National Welding Supply Association, Statler-Hilton Hotel, Detroit.

September 28-29: Eastern Zone Meeting, N.W.S.A., Hotel Roosevelt, New York City.

October 11-16: Pacific Area National Meeting, American Society for Testing, Sheraton-Palace, San Francisco.

October 19-20: West Central Zone Meeting N.W.S.A., Pick-Nicollet Hotel, Minneapolis.

October 22-23: Western Zone Meeting, N.W.S.A., Riviera Hotel, Las Vegas, Nevada.

November 30-December 1: Southeastern Zone Meeting, N.W.S.A., Atlanta Biltmore Hotel, Atlanta.

December 3-4: Southwestern Zone Meeting, N.W.S.A., Hotel Texas, Fort Worth.

April 25-29: 41st Annual Meeting and Welding Exposition, American Welding Society, Los Angeles.

This is all the room you need to weld with LINDE's "MIGHTY MIDGET"

... New Heliarc HW-20 Torch

HIGH CURRENT CAPACITY

Operates at 200 amperes *continuous* duty, AC or DC. Molded, totally closed water-cooling system eliminates any chance of leaks at torch head.

MINIATURE SIZE

9/16- by 2-5/16-in. torch head permits welding in hard-to-reach areas as small as 3 in. in diameter. Total torch length is under 7 inches.

3.3-OZ. FEATHERWEIGHT

Selected materials, such as glass fiber reinforced phenolic plastic, save weight without sacrificing strength. Torch (with short cap) weighs only 3.3 ounces.

HANDLES LIKE A PENCIL

Exceptional balance, light weight, small size, and super-flexible service lines make the HW-20 torch as easy to handle as a pencil.

For further information, call your local LINDE Office or LINDE Distributor . . . or write: Dept. IW-08, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, New York.

SPECIFICATIONS

Capacity—
200 amp. AC or DC, continuous duty cycle;
225 amp. AC or DC, reduced duty cycle

Weight—
with short cap: 3.3 oz.*
with medium cap: 3.5 oz.
with long cap: 3.6 oz.

Length overall—6⅞ in.

Length of Torch Head—
with short cap: 2-19/64 in.*
with medium cap: 3-9/32 in.
with long cap: 7-5/16 in.

Maximum Handle Diameter—¾ in.

Maximum Head Diameter—9/16 in.

Service Lines—12½ or 25 ft.

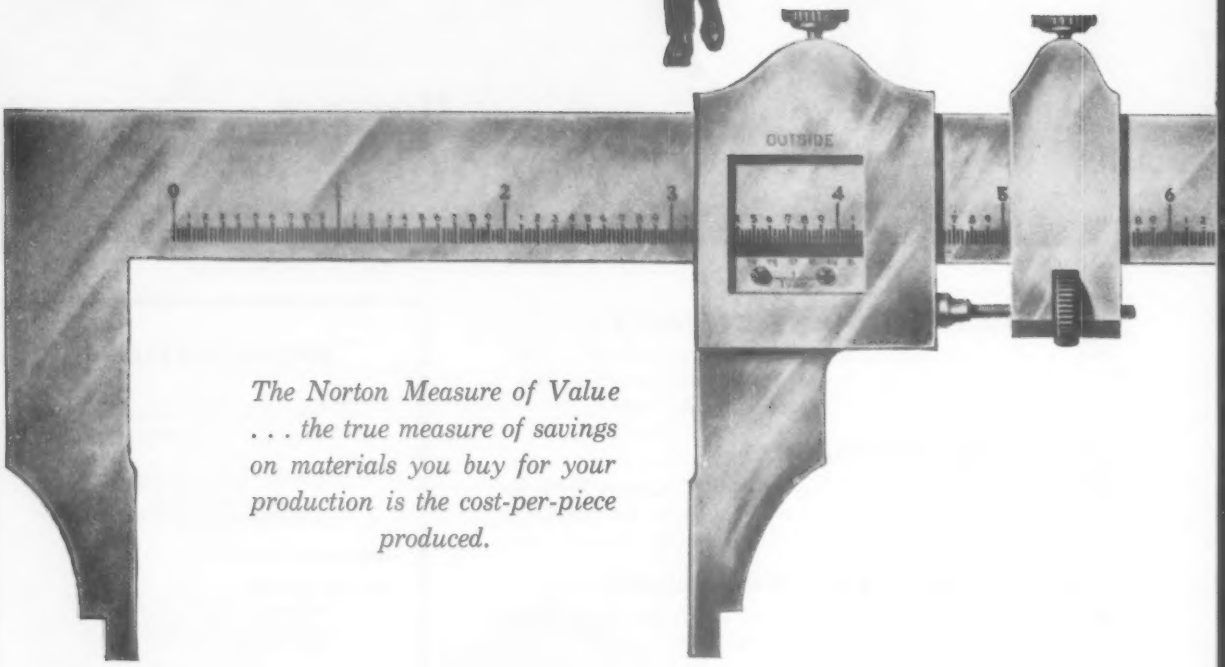
*Torch is supplied with medium cap for 3-in. electrodes. Short cap for 2-in. electrodes and long cap for 7-in. electrodes are available as accessories.

Linde UNION CARBIDE

The terms "Heliarc," "Linde," and "Union Carbide" are registered trade marks of Union Carbide Corporation.

For More Information Circle No. 39 on Reader Service Card.

Call your Norton Man — he has the experience, the products, and knows how to save you money where it counts. There's a Norton expert in the fields of — abrasives, grinding machines, refractories.



The Norton Measure of Value . . . the true measure of savings on materials you buy for your production is the cost-per-piece produced.

Economists could argue the definition of the value of a grinding wheel in many ways. But it would usually come down to this — What is it worth to the purchaser.

You can buy less expensive grinding wheels than Norton wheels and save on immediate cost. But if the lower cost wheels do not perform their jobs efficiently or cause production delays because of poor quality or wheel misapplication — you haven't made a bargain — you've made a costly mistake.

The only accurate measure of the value of a grinding wheel is how much it produces for you per dollar cost — not merely how much you paid for it. Here is why Norton grinding wheels are worth more to you —

Norton Company gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field — and you get this great scope of detailed knowledge on a personal basis — your Norton Man.

Every Norton Man starts his career by spending a minimum of one year in a carefully planned training course in the Norton plant and a comparable period of training in the field to assure a broad, thorough understanding of grinding before he goes "on his own." The average experience of all Norton Men in the field is 15 years in addition to their specialized training. The Norton Man is the most knowledgeable man in abrasives that you can consult. Make him your consulting abrasive engineer.

He will make an Abrasive Requirement Study for you.

You can produce greater savings than you can buy

This study lists the correct specifications for each abrasive job in your plant to assure you lowest cost-per-piece produced. He is also available for complete field testing on specific problems.

For example, your Norton Man can increase production by pointing out ways for better wheel usage and fewer wheel changes. He has the widest selection of grinding wheels in the industry from which to select the best wheel for new product grinding operations and for improving your current grinding jobs — both at the lowest cost. And with Norton grinding wheels you can be sure of precise duplication order after order.

Norton offers true abrasive economy. Economy that pays off in lower cost-per-piece produced. Call your Norton Man. NORTON COMPANY, General Offices, Worcester 6, Mass.

W-1873

NORTON
ABRASIVES

Making better products . . .
to make your products better

For More Information Circle No. 45 on Reader Service Card.

TIG welding is "right" for so many jobs...

Outdoor furniture made of steel tubing, is TIG-welded for smooth, slag-free welds and greater strength

Magnesium ramp for trailer trucks features rugged TIG welding of plates and channels

...and Sylvania Tungsten Electrodes do the job right...everytime!

FROM lightweight outdoor furniture to giant magnesium truck-ramps . . . Tungsten Inert Gas Welding is adaptable to almost any job. But the quality of the weld is only as good as the tools you use . . .

That's why TIG welders prefer Sylvania Tungsten Electrodes. You can take your pick of all 4 electrode types: Puretung®, Zirtung®, 2% Thoriated, 1% Thoriated. They're available with cleaned or ground finish. And they're color-coded to prevent waste and costly errors.

Sylvania Tungsten Electrodes are available through all leading distributors. Call yours today.

SYLVANIA
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

Sylvania Electric Products Inc.
Chemical & Metallurgical Div.
Towanda, Penna.

For More Information Circle No. 57 on Reader Service Card.

MEN ON THE MOVE

in the welding industry

PROMOTIONS:

Sawyer

Herbruck

The Lincoln Electric Co. has appointed **Ansley W. Sawyer, Jr.** as Director of Advertising and Sales Promotion and **Charles G. Herbruck** as Assistant Secretary, Public Relations and Publicity.

Sawyer joined Lincoln 1948 as a methods engineer. He entered the company's advertising and sales promotion department in 1950.

Hebruck joined Lincoln in 1942 and worked as a foreman and night superintendent. In 1947 he became an assistant to the late A. F. Davis, working with the company's educational and publishing program.

J. J. Dall has been appointed assistant general manager, electric welding, *Linde Company, Division of Union Carbide Corp.*

National Cylinder Gas Division of Chemetron Corp. has made four promotions. New district managers are **Lawrence J. Roper,** Kansas City, and **Robert E. Buzard,** Portsmouth, Va. New assistant district managers are **Oscar F. Boerner,** North Bergen, N. J., and **Lauren W. Sage,** Cincinnati, Ohio.

Twining

E. S. Twining, Jr., has been appointed vice president-marketing, it was announced by **R. E. Lenhard,** president of *Air Reduction Sales Co.*, the industrial gas and welding products division of Air Reduction Co., Inc.

G. L. Werly, Jr., succeeds Twining as manager, gas department-marketing.

Promotion of **Edwin F. Goad** to marketing supervisor for coated abrasives and related products division has been announced by *Minnesota Mining & Manufacturing Co.*

William M. Haile has been elected vice president of *Union Carbide Corp.* He is succeeded as president of *Linde Company* by **William B. Nicholson.**

ELECTIONS:

Newly elected president of the *Resistance Welding Alloy Association* is **James C. Cox.** Mr. Cox, who is president of *S-M-S Corporation,* succeeds **J. A. O'Grady** of *Weldaloy Products Co.* New vice president is **H. A. Mullen,** manager of *Ampco Metal's* Resistance Welding Department.

Edwin M. Miller and **G. E. Willis** were elected to the Board of Directors of the *Lincoln Electric Co.*, Cleveland, Ohio. Mr. Miller is superintendent of Lincoln's Machine Division; Mr. Willis is superintendent of the Electrode Division.

APPOINTMENTS:

Vogl

Cassidy

Wilton Tool Mfg. Co., Inc., has announced the appointment of **Alex J. Vogl** to the office of president. At the same time **William Ferrick** was named vice president-sales manager.

Newly appointed to the position of Chicago District sales manager for *Page Steel & Wire Division, American Chain & Cable Co., Inc.*, is **John C. Cassidy.**

Appointment of **Harry Rankin** (right) to direct research and product development activities in the hardsurfacing field has been announced by **David Rankin** (left) president of *Rankin Manufacturing Co.*, Alhambra, Calif. Area of research laboratories has been doubled and new equipment installed.

Chester N. Pearsall and **K. Dale Swanson** have been appointed field engineers by *Norton Company,* Pearsall has been assigned to the Pittsburgh District Office; Swanson reports to the Pacific Coast District Office at Los Angeles.

Harnischfeger Corporation's Welder Division has added two representatives to its sales staff: **Paul H. Peterson,** southern half of Chicago and parts of Illinois and Indiana, and **Alfred Q. Neil,** northern half of Chicago and upper portions of Illinois and Iowa.

Champion Rivet Company has made two appointments. **Lew Van Auken** has been appointed district manager for the Cincinnati area, while **Kenneth Lee** has joined the sales staff at Champion's East Chicago, Indiana, plant.

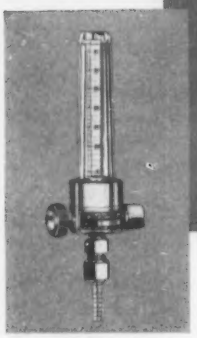
William J. Bradley has been appointed factory manager and **Kenneth L. Madden** has been named manager of quality control at *Superweld Corp.*, North Hollywood, Calif., high temperature brazing firm.

Forest Tiffany has been appointed director of market development for *Olin Aluminum, Metals Division, Olin Mathieson Chemical Corp.*

Ernest A. Siemssen has been appointed chief engineer of the Automatic Machinery Division of *Selas Corp. of America,* Dresher, Pa.

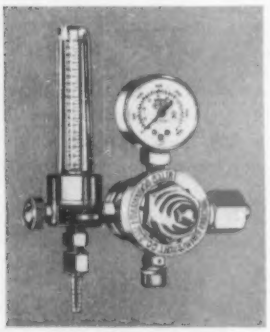
VICTOR REGULATORS & VICTROMETERS

give you precise control and measurement of gases



MODEL V SERIES
INDUSTRIAL
VICTROMETER

Victor regulators and flowmeters provide accurate, safe control and measurement of gases used in industrial applications, such as welding and cutting; gas shielded arc welding; laboratory work; atmosphere control; furnace operations, etc. For use with oxygen, air, argon, helium, nitrogen, hydrogen, carbon dioxide, and other gases.



VICTOR
REGULATOR-VICTROMETER
COMBINATION UNIT

- **FEATURES:** Construction—compact, sturdy design provides adequate capacity with minimum weight and size.
- **VICTOR SINGLE-STAGE REGULATORS** meet requirements of capacity and delivery pressure with minimum variation.
- **VICTOR TWO-STAGE REGULATORS** are recommended for operations requiring constant delivery pressure over a range of varying inlet pressures.
- **INDUSTRIAL VICTROMETERS** provide reliable, efficient measurement of gas flow. Gauge is visible from all sides. Tubes and floats can be easily changed or adjusted for different gases and flow rates.
- **REGULATOR-VICTROMETER COMBINATIONS**—Single or two-stage regulators may be combined with Victrometers making a compact unit that both regulates and measures gas flow.

Specify Victor for your job. See your Victor dealer or write us.

VICTOR for regulators and flowmeters

VICTOR EQUIPMENT COMPANY 59

Mfrs. of high pressure and large volume gas regulators; welding & cutting equipment; hardfacing rods; blasting nozzles; cobalt & tungsten castings; straight-line and shape cutting machines.

844 Folsom St., San Francisco 7 • 3821 Santa Fe Ave., Los Angeles 58 • 1145 E. 76th St., Chicago 19
J. C. Menzies & Co., Wholly-Owned Subsidiary

For More Information Circle No. 66 on Reader Service Card.

For 27 Years Preferred By Welders

THE DURO "STANDARD"

- All Parts quickly replaced with a screwdriver
- Screw-in type jaws — No tools required
- Insulated Handle and Guard — Protects operator
- Rugged Fibre Handle — Lasts longer
- Cool Operation — Cool Handling

Featuring "Long Jaw design" for reaching those "hard to get at places".

The New Duro "DUROGON" Tong-Type

THE DUROGON-N3 and N3HD

- All Parts quickly replaced with a screwdriver
- Fully Insulated — Greater safety
- Cool Operation — Cool Handling
- With ALUMINUM Body — Less operator fatigue
  Mechanical Cable Connection
- With BRONZE Body — For heavy duty operation
  Mechanical, soldered or brazed connection

"The BEST of this Popular Design!"

DURO ENGINEERING COMPANY · 81 OREGON AVE. · HAMDEN, CONN.

For More Information Circle No. 18 on Reader Service Card.

FREE BULLETIN...
TURN TRASH INTO CASH

Just produced by Handy & Harman—this new Refining Bulletin describes the great cash potential in precious metals industrial waste... lists many possible sources. Types and forms of refinings are illustrated photographically and described in text. Equally important, the bulletin calls attention to the fact that much of industry's valuable waste is truly wasted.

For your free copy of this new and cash-provoking bulletin, write to Refining Division, Handy & Harman, 82 Fulton Street, New York 38, N.Y. Your biggest dividend will come when you send a refining lot to Handy & Harman and see for yourself the cash benefits you get from the country's leading refiner of precious metals waste.

Your No. 1 Source of Supply, Refiner and Authority on Precious Metals Alloys

Refining Plants & Collecting Stations:

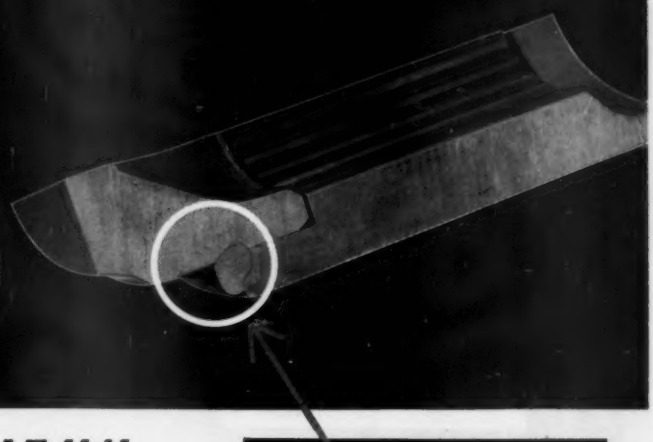
Bridgeport 1, Conn.
Chicago 22, Ill. 1900 W. Kinzie Street
Providence 3, R. I. 425 Richmond Street
El Monte, Calif. (Los Angeles) 330 North Gibson Road
New York 38, N. Y. 82 Fulton Street
Toronto 2B 141 John Street

HANDY & HARMAN
General Offices: 82 Fulton St., New York 38, N.Y.

For More Information Circle No. 30 on Reader Service Card.

NEW WIRE

WELDS TWO HIGH-CARBON RESULFURIZED STEELS



Now You Can Weld SAE 1141 to SAE 1151----with CO_2 and

PAGE A-S-18

The cutaway portion of a drive shaft shown above was produced on an automotive production line. It consists of two welded pieces of high-carbon, sulfur-bearing steel—SAE 1141 and SAE 1151. Note the clean metal in the weld.

Previously, it has been impractical to weld these grades of steel by inert gas or submerged arc methods. Pre-heat and post-heat normally were required resulting in the annealing of the pre-hardened sections of the steel.

New PAGE Analysis A-S-18 solves this problem. Using PAGE A-S-18, without pre-heat and post-heat, you can obtain a high-quality, non-porous weld on any free-machining steels in the SAE 1100 series, or on any .25 to .50 carbon steel. For instance, .35 carbon steel joints welded with A-S-18, using CO_2, produced tensile strength of 75/81,000 p.s.i.—yield strength of 55/61,000 p.s.i.—elongation of 24%.

PAGE A-S-18 may be an answer to your welding problem. Why not try it?

A portion of a drive shaft shows perfect weld around circumference, a result of high elongation of PAGE A-S-18. The weld was accomplished in two passes.

Let PAGE Help Solve Your Welding Problems

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Folder DH-402-C Contains information on submerged arc and inert gas automatic welding wire. Lists descriptions and uses of the many PAGE analyses. Describes our extensive variety of packaging. Illustrated.

Folder DH-1218 • Chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Shows uses and physical properties. Lists most competitive makes.

When you bring your welding problems to PAGE, you get the benefit of over half a century of wire drawing experience and leadership in metallurgical research. Leadership evidenced by the industry's widest range of analyses —33 grades designed to do an endless variety of welding jobs. Let PAGE help you improve your quality and lower your costs by furnishing the right wire for your job.

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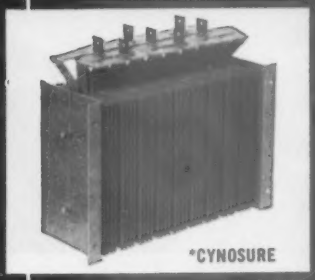

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. . . rectifier type welder ever created!

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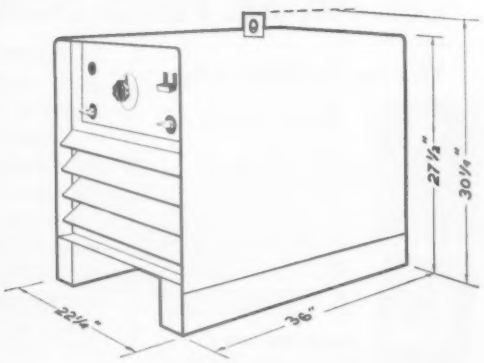
Built to withstand the most demanding industrial d-c welding applications, including carbon arc service, this series is available in four basic models with 60% duty cycle ratings of 200, 300, 400 and 600 amperes. Duplex models to 1200 amperes. Shown to right is line drawing of the "horizontal" model for use where space is limited, or for outdoor use.

Complete particulars will be sent promptly, or a demonstration by your local distributor will be arranged at your convenience.



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*CYNOSURE: Anything to which attention is strongly turned; a center of attraction.

For More Information Circle No. 43 on Reader Service Card.

AUGUST, 1959
Welding Design & Fabrication
ESTABLISHED IN 1930 AS INDUSTRY & WELDING

Russia's New 7-Year Plan Calls For 40% More Automatic Welding

says the official Russian journal "Automatic Welding"

EDITOR'S NOTE: *This article is taken from the January, 1959, issue of the monthly Russian journal, Automatic Welding, which is published by the E. O. Paton Arc Welding Institute, a section of the Ukrainian S.S.R. Academy of Sciences.*

This journal is being translated monthly by the British Welding Research Association. Annual subscriptions are $30. Money should be sent to the BWRA, 29 Park Crescent, London W1, England.

We do not necessarily agree with the views and claims that follow:

As a Result of the triumph of socialism, the Soviet Union has embarked on a period of gradual transition from socialism to communism.

The Soviet people are setting out to fulfill a new seven-year plan—a historic program for the development of communism in the USSR. Soviet welders in science and industry are determined to make their contribution.

The principal task of the plan for 1959-1965 is laid down in Comrade N. S. Khrushchev's address to the twelfth congress of the C.P.S.U. It involves further great increases throughout our economy by the priority development of heavy industry. This will considerably strengthen the economic power of the country ensuring continuous rise in the standard of living.

Steel production under the plan will increase by 1965 to 89-91 million tons, i.e. 56-65% more than in 1958; 65-70 million tons will be rolled, which is 52-64% more than in 1958. The plan also provides for a considerable increase in the output of nonferrous metals, primarily aluminum (2.8 times the 1958 tonnage).

The increase in metal output will be followed by a rising production of different types of welded structures.

Simultaneously with increases in the quantity of welded structures, great changes must take place in welding techniques. The average level of mechanization of welding will rise rapidly by 40% by the end of the seven-year plan; in boiler-making and locomotive production it will be 50%, in the building industry about 60%, in rolling stock manufacture 70%, and in shipbuilding 85%.

The use of automatic and semi-automatic submerged arc welding and resistance welding is to be multiplied 2.5 times. The use of electro-slag welding

Russia claims these welding firsts . . .

- Electro-slag welding of extra-thick plate.
- Advanced methods for welding in a carbon dioxide shielding atmosphere.
- A new-principle friction welding method.
- New methods for mechanized resistance welding of oil and gas pipelines.
- Advanced methods of welding steel for concrete reinforcements.
- Highly efficient methods of multi-arc, multi-electrode and multi-phase submerged arc welding and hard surfacing.

Russia has these welding goals . . .

- Increase use of automatic welding by 50 to 85 percent in key industries.
- Shift to continuous and automatic welding lines with latest, high efficiency welding equipment.
- Develop new and better methods for vacuum brazing, electron beam and stored energy welding.
- Produce austenitic electrodes from steels and alloys which are free from gases and injurious low-melting impurities.
- Train designers to turn out efficient, reliable and light weight weldments.

is to be doubled and gas-shielded arc welding will be used six times as much. The electro-slag process for improving the quality of ingots and castings by electro-slag feeding must become more widespread; so also must the improvement of the quality of high-alloy steels and alloys by means of electro-slag remelting.

Welding will be developed through the most up-to-date techniques and the wide application in industry of Soviet welding science. But, there is still a gap between the level of the latest developments in welding techniques and industrial welding practices.

Soviet welding achievements both in science and in practice have enabled our metal-working industry to outstrip the most highly developed capitalist countries in a number of fields. In Russia we have developed the modern method of electro-slag welding for plate of practically unlimited thickness, bringing about a revolution in heavy engineering. We have developed advanced methods of welding metals in a shielding atmosphere of carbon dioxide gas, and a method of friction welding by a new principle has been proposed.

By the use of timing circuits for resistance welding, Soviet scientists and industrial workers have mechanized the welding of oil and gas pipe lines in a new way. In principle the mechanization of welding in erection and field conditions has been solved.

Highly efficient methods of multi-arc, multi-electrode, and multi-phase submerged-arc welding and hard facing have been developed earlier in the USSR than abroad. An advanced method of producing welded thin-wall large diameter steel tube with straight and spirial welds for high pressure mains has evolved from high-speed multi-arc submerged arc welding

We were the first to use advanced methods of welding steel reinforcement for concrete.

Soviet welding engineers have mastered the welding of many new structural steels and alloys, and new metals such as titanium; they have put the study of the weldabilities of metals and alloys on a genuinely scientific basis. Soviet structural engineers have developed new designs for various types of welding equipment and machinery and current sources for arc, electro-slag, and resistance welding (for example, trackless machines and self-propelled heads for submerged-arc welding, the combined transformer and current regulator, electro-slag welding equipment, etc.).

It should, however, be recognized that modern welding techniques have still been adopted on too small a scale in a number of branches of industry. This backwardness must be put right in the coming seven years.

The seven-year plan provides for the basic expansion and reconstruction of existing undertakings in manufacturing industry through full mechanization and automation of production involving renewal and modernization of much equipment.

In this connection, serious attention must be paid between 1959 and 1965 to expanding the output of the latest types of welding and jigging equipment, and also of equipment for mechanized welding. We must shift from the mechanization and automation of separate welding operations to the mechanization and automation of processes as a whole, and to continuous and automatic lines equipped with the latest high efficiency welding equipment.

Comrade N. S. Khrushchev's address calls for the large-scale adoption of the Paton method for the production of various components by welding. This will reduce considerably unproductive and laborious work in casting, forging and other methods of metal working.

A large number of blast and open hearth furnaces and new cement works will be built in the next few years. When these plants are built, site welding is to be fully mechanized for the first time in the world.

Special tasks face those responsible for welding techniques in connection with the huge expansion planned for the chemical industry and the new trends in power generation and the fuel industry.

The total output of the chemical industry is to be almost trebled between 1959 and 1965. The production of synthetic materials, nitrate fertilizers and sulphuric acid will increase greatly.

Over 140 large chemical undertakings are to be constructed or completed, and over 130 will be rebuilt. To give these works the latest equipment, the Soviet engineering industry must multiply by nearly 3.5 times its output.

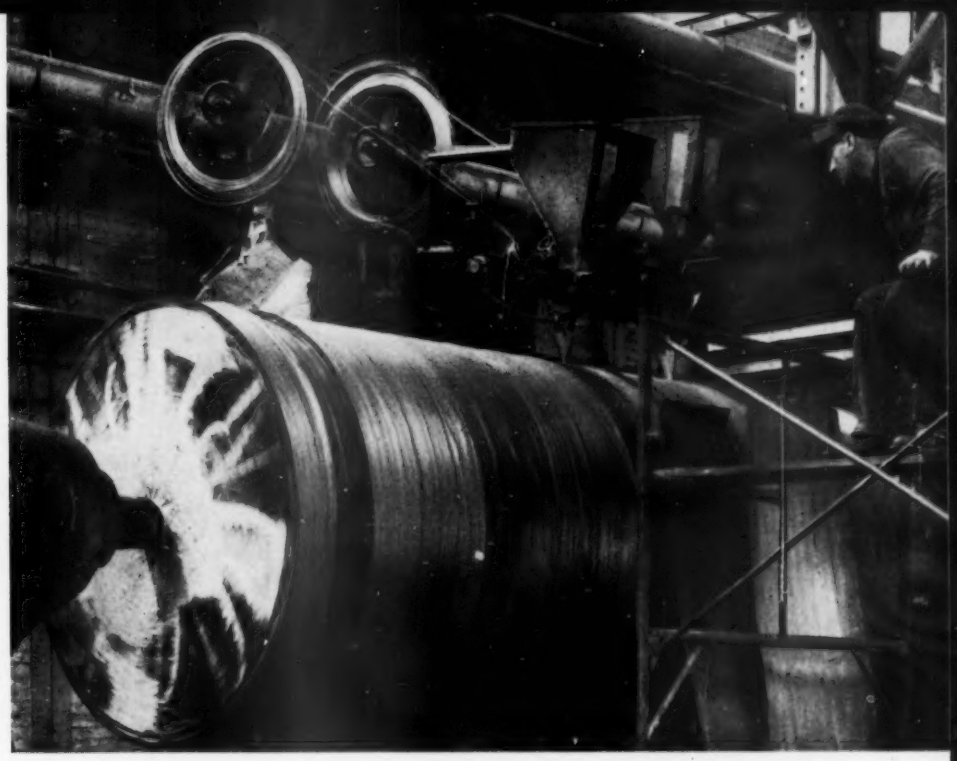
Soviet welding engineers must as soon as possible improve present methods and invent better ones for the welding of chemical plants. In this connection the following processes must be developed: brazing in a vacuum, welding by electron beam, welding in hermetically sealed chambers filled with helium, welding by stored energy, etc.

The forthcoming seven-year plan will be decisive in the achievement of Lenin's ideal of the continuous electrification of the country. No less than 60 million kW of new capacity must become effective between 1959 and 1965. As we know, much funds and time are required for equipping hydro-electric power stations. The central committee of the C.P.S.U. has decided to build mainly thermal power stations in the next few years. Between 1959 and 1965, 2.5 times more funds will be spent on building these stations than between 1952 and 1958.

Electrical capacity will be basically increased by the construction of powerful and economic steam turbine condensing power stations of 600,000 to 1,200,000 kW or more. Turbine generator sets of 150-200,000 kW capacity will be supplied from the same boiler at these power stations. Superheated and super-high pressure steam at over 600°C. and 200-240 atm. will be increasingly used. Boiler assemblies and turbines to work under these conditions are being built of large high-alloy steel castings and forgings. They are welded to thick-wall seamless tubes, not only at the works, but also on the site.

Without exaggeration it may be stated that the successful solution of the new and magnificant tasks facing the Soviet electrical power industry depends to

continued on page 48



Midvale-Heppenstall had over 5,000 feet of weld to deposit. They doubled the rate by using two submerged arc heads instead of one.

7,500-Ton Press Ram Uses A 1,500 Lb. Aluminum Bronze Overlay

by **VICTOR NIGRINY**, *welding engineer, Midvale-Heppenstall Co., Philadelphia*

IN BRIEF: The author explains the planning and procedures that went into protecting a big forging press ram from sliding friction wear.

SLIDING FRICTION can shut down a forging press in a hurry if its parts are not fully protected against it. A 7,500-ton press ram, one of many we have supplied to press manufacturers, is a good example. Properly overlayed it will last for years; without protection it would wear out after producing but few forgings.

Our company and our supplier, J. A. Cunningham Equipment, Inc., also of Philadelphia, had to carefully plan the right overlaying method and material. It wasn't simple.

The ram was a big .35 carbon steel forging—52 inches across and 9 ft. long. Eight feet of this length (an area of 110 square feet) required overlaying.

Putting this much metal on economically, effectively, and with complete assurance of long service life meant we had to answer questions of:

1. Handling and positioning
2. Choice of filler metal
3. Welding process
4. Welding procedure

Handling and positioning were the least of our worries. We had large cranes, including the 75-tonner we used; we already had large lathes for our other forging work. We chucked the ram in the 12-ft. diameter face plate and supported the other end with a live center. We could vary the lathe speed to match the welding process.

Close cooperation between our company and Cunningham was helpful. They recommended an aluminum bronze filler metal because it wears excellently on sliding parts. It's 10 percent aluminum, 1.5 iron, and the rest copper.

This filler metal can be rapidly applied by the submerged arc process using a special flux. But because we had such a large area to cover, we knew that a single welding head would be too slow. So we put another on the traveling manipulator, about 30 inches away from the first. Each head had its own power, wire and flux supply and could be controlled independently.

We paralleled two sets of 400 amp. rectifiers for welding current and used 350 amps, 32 volts on straight polarity d.c. Travel speed was 15 ipm. This current is a lot less than we would use if we were depositing steel.

Preparation for welding consisted in undercutting the ram enough to end up with at least ¼-inch alu-

continued on page 53

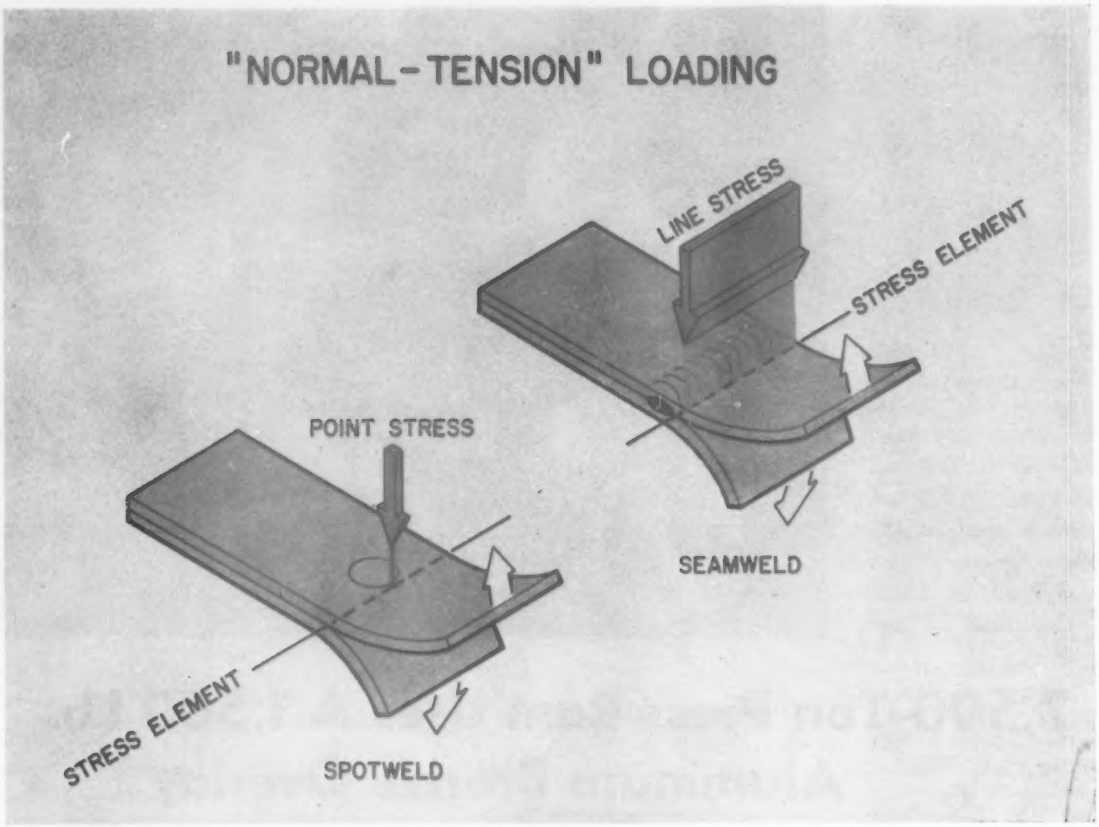


FIGURE 1: Any load normal to the skin produces a peeling effect.

Are Spot And Seam Welds Practical In Tension? Peel Tests Say Yes

IN BRIEF: Results of peel tests help designers use spot and seam welding to get simpler, lighter and more reliable airborne structures. Resistance weld peel testing is done on two strips of metal joined by spot or seam welds. The unwelded ends are separated and pulled apart. In a sound weld complete shearing will take place on both sides of the weld, not in it.

DESIGNERS AT North American Aviation, Inc., in Downey, California, are very confident in designing airborne structures that take resistance welding. Why? Because their research engineers have done extensive research on resistance weld peel testing. The results of these tests give designers a choice way to select the best and most practical designs for spot and seam welds used in tension.

What did engineers find out about peel testing?

First, they found that "tension" is not descriptive of all variables affecting joints under tension loading.

Second, they found that you can't use only *one* tension specimen for design criteria.

Third, they found that a range or family of tension conditions exists for each material (See Graph A).

Fourth, by various peel techniques they can locally strengthen spot weld peel performance. (See Figure 2 for various peel-reducing techniques.)

Two steps were taken to get good design data and check out theories about some of the peel test techniques illustrated. One was to test their peeling characteristics. This was done to develop their different strength ranges.

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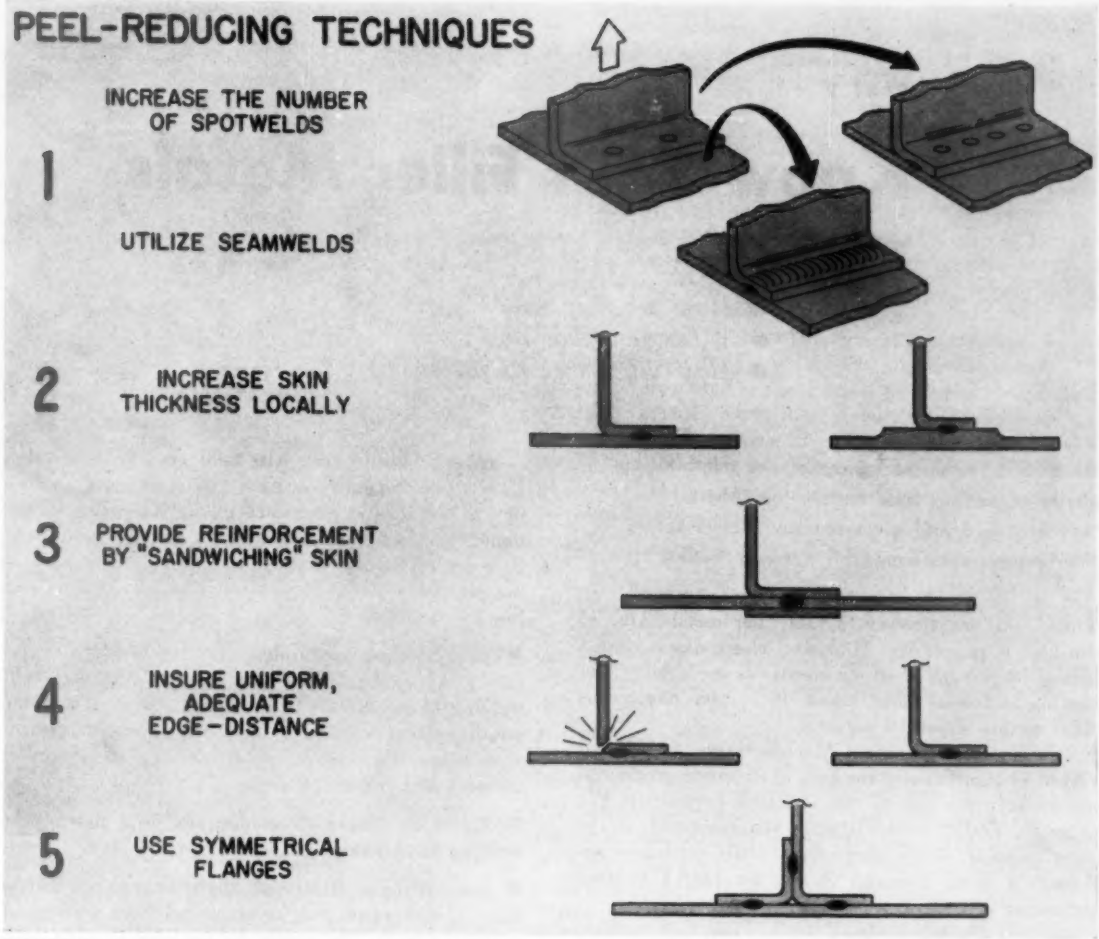


FIGURE 2: North American Aviation uses these peel-reducing techniques.

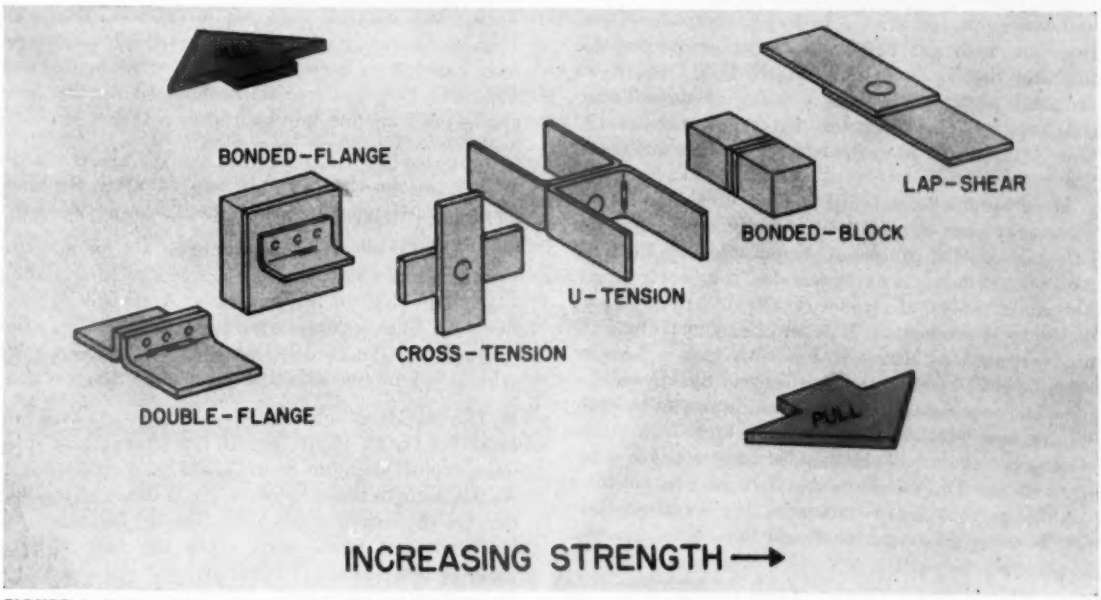


FIGURE 3: Test configurations are plotted in their order of increasing peel resistance.

PART 2 of three

Know Your Filler Metals

by ORVILLE T. BARNETT, *assistant manager, metals research, Armour Research Foundation*

- *How are they rated?*
- *Where are they used?*
- *How do you select them?*

IN BRIEF: The author discusses the relative popularity of various filler metals, tells where they are used and gives ten key factors for their proper selection.

THERE ARE MANY WAYS to rate filler metals. One of the best is popularity. Mild steel electrodes represent almost 80 percent of all the electrodes used. Alloy (including stainless) steel about 19%, and nonferrous filler metals about 10 percent.

The National Electrical Manufacturers Association (NEMA) figures cover the bulk of electrode producers, are an accurate way to rate electrode popularity. For example, E6012 rutile (titania sodium type) is the most popular single electrode: E6010 (cellulose sodium) is next, followed closely by E6013 (titania potassium type).

Almost 10 percent of the total production are the iron powder types E6024 and E6027*. Heel-close and coming on fast are low hydrogen electrodes. These two—low hydrogen and iron powder electrodes—are probably the fastest growing of all. E6011 electrodes are only about a third as popular as their E6010 counterparts. This indicates that there is more DC than AC welding, even though AC has advantages in heavy fabrication.

More automatic welding is used every day. Most automatic wire is consumed by submerged arc and CO_2 gas shielded processes. Argon shielding for mild steel filler metals is not very popular. It costs too much. The E6020-E6030 electrodes represent only 4 percent of the total production. It is surprising that they are used as much as they are. Evidently this is because some fabricators either haven't learned the advantages of semiautomatic or fully automatic processes or their fabrications involve short welds, which iron oxide electrodes can do best. Unshielded bare wire arc welding with the E45XX electrodes isn't used as much as the 0.6 percent figure indicates. It's quite possible that some of this material should have been reported as automatic wire.

*NEMA figures do not include the other iron powder types.

Where should you use mild steel filler metals? Bare wire, of course, is used mostly for gas welding or arc welding buildup and repair. Contrary to the name, bare wire for arc welding usually contains a light arc-stabilizing coating. Bare wire arc welding is not popular because its deposit is usually porous and low in ductility.

■ The cellulose electrodes (E6010-E6011, and related) are used primarily for pipe welding, for field welding of storage tanks and structural steel, and for out-of-position welding in pressure vessels. A typical shop use is the welding of reinforcing pads around manway and nozzle openings.

■ Rutile or titania electrodes are used mostly for welding farm equipment and structural steel.

■ Low-hydrogen electrodes are preferred for earth-moving equipment and for shop and field welding of pressure vessels. They must be used for welding high sulphur steels, enameling stock and high carbon steels. These can't stomach hydrogen in or round the weld. The low-hydrogen coatings are practically moisture-free. Fabricators keep them dry in ovens before use. The other hydrogen-free electrodes used for the same applications are the low hydrogen, iron-powder compositions.

■ Iron powder electrodes are used in exactly the same places as their counterparts without iron powder.

■ Iron oxide electrodes find greatest use for pressure vessel, machine base, and other large structure welding —generally for thicker materials. A typical application: the fillet welds joining plate at least $\frac{3}{8}$ inches thick. The joint needs quite a bit of heat capacity (thickness) for the effective use of these electrodes.

■ The low alloy-high strength electrodes are available in XX10, 11, 13, 15, 16, and 18 types ranging in minimum deposit strengths from 70,000 psi to 120,000 psi. As the strength levels increase, the coatings swing into the low hydrogen types. The reason for this: the low hydrogen types won't crack the heat affected zone, their welds aren't hot short, nor will they crack in the blue-brittle range.

POPULARITY RATING OF FILLER METALS (NEMA-1957)

ALL TYPES

DESCRIPTION	% OF TOTAL
MILD STEEL	89.6
ALLOY STEEL	10.0
*NONFERROUS	0.4

MILD STEEL

E6012	27.7
E6010	20.0
E6013	17.1
E-6024-27	9.6
LOW HYDROGEN	7.4
E6011	7.3
AUTOMATIC WIRE	5.8
E6020-30	3.9
E45XX	0.6

*Probably low

■ Cellulose coatings (primarily on the E7010 electrodes) are mostly used for pipeline welding because the deposits are strong and the electrodes easy to use in all positions. While the high-cellulose, potassium and titanium potassium types are designed for the same purposes as the sodium equivalents, these electrodes aren't used much.

■ In the lower strength levels, the low hydrogen potassium coatings have almost replaced the low-hydrogen sodium types; but use of the d.c. straight polarity low-hydrogen sodium types (E7015) still persists for high strength electrodes—with the popularity nod going to EXX15. However, the preference in low-alloy, high strength electrodes is switching toward the XX18 types.

Automatic welding wires for mild and low alloy steels fall into three groups: medium and low-carbon steel, high-tensile and low-alloy steel. The medium and low-carbon steel and the high tensile steel wires are used for both submerged arc and gas shielded welding. Submerged arc is probably the most important process for high tensile welding with CO2 in second and coming fast, and inert gas shielded welding in third position.

Low-alloy steel wires follow the chemistry and mechanical properties of the base metal for which they are intended. Thus, the availability of the carbon-moly, and chromium-moly, chromium-nickel-moly, and chromium-zirconium analyses. There's also a need for wire that matches the steels used for missile and aircraft work. These are being developed.

What are the electrodes for, welding cast iron? Where are they used? They come in several types. There's cast iron, copper-base, nickel-base, or steel. You can weld cast iron with either gas or arc processes. Which to use usually depends on the size of the casting; massive castings are generally easiest with gas; thinner sections can be effectively arc welded. If doubt remains, experiment with both.

Gas welding is preferred for welding cast iron with the copper-base filler metals. The copper-zincs, low-fuming bronzes such as naval brass, manganese bronze or nickel bronze, are typical examples. The copper aluminum and copper-tin filler metals are commonly used to arc weld cast iron. The nickel-base electrodes, like the steel-base electrodes now seldom used, are arc welding types exclusively.

Ten significant factors influence the choice of filler metals:

1. Codes and standards must be met. Typical bodies specifying codes and standards are: ASME, American Welding Society, and the municipalities. The electrodes have to meet the requirements of the specification.

2. The composition of the metal being joined has a lot to do with the choice of filler metals. You wouldn't weld low-alloy steel or stainless steel with mild steel electrodes. You wouldn't weld cast iron or nonferrous materials with the wrong filler metal. Sometimes it's hard to know which one to use. There are many excellent references to help you, including my book "Filler Metals for Joining".

3. The condition of the metal being welded influences the filler metal you select. Your base metal might be oily, rusty, galvanized, or scale-free. Base metals weld best when they are clean. If you can't clean them properly, use a filler metal like E6010, that will bite through the rust. On galvanized steel use a filler metal that will damage the galvanize the least. A good choice would be an aluminum bronze with tungsten arc.

4. Remember the mechanical properties a weld must have. For example, earth-moving equipment often works in the extreme cold and takes severe impact. Filler metals chosen must be equal to this service. Other properties have to be considered too—tensile or yield strength, ductility, hardness—if important to the design. For example, for power piping, chrome-moly electrodes are frequently specified because their deposits withstand graphitization, encountered in long-time, high temperature and pressure operations.

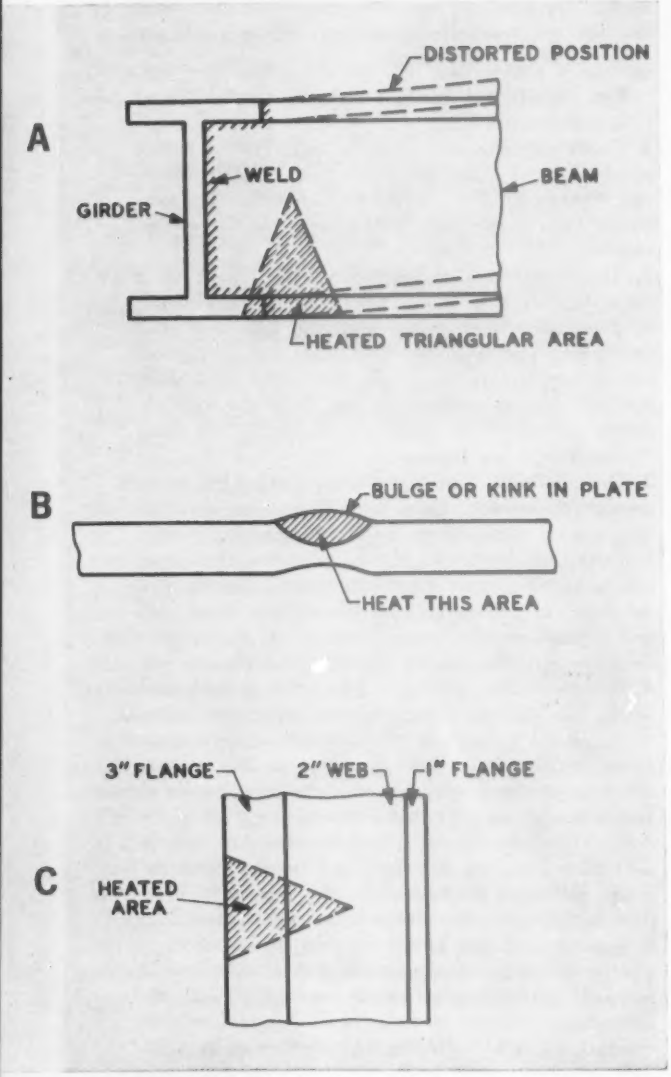
5. Joint tests figure prominently in the selection of filler metals. If these include radiography, ultrasonic or magnetic particle inspection, or mechanical tests, the filler metal will have to be good enough to pass. For example, if E6012 electrodes were used to make multi-pass pressure vessel welds (few welding engineers would choose them for this) the welds probably would be porous. X-ray inspection would show that the joint

continued on page 52

If kinks, bulges, bends and distortion can't be pressed out...

Use Low Cost Heat Straightening

by **LOUIS J. LARSON,** *consulting engineer, Allis Chalmers Mfg. Co., Milwaukee*



PIE-SHAPED heating pattern used on gun mount base (A) and Betatron arm (C) pulls members toward its broad base. Spot heating of plate (B) eliminates bulge.

IN BRIEF: The author describes a convenient, effective and inexpensive way to straighten out weldments and other metal structures.

COMPLETED WELDMENTS must often be straightened. Some can be straightened in a press but this isn't always practical, safe, or possible; available equipment may not be big enough to do the job. If heavy weldments are straightened cold there is always the danger of failure.

What do you do then when you've got a kink or bulge that can't be tolerated? Fortunately there is a convenient, effective, and inexpensive way—heat straightening.

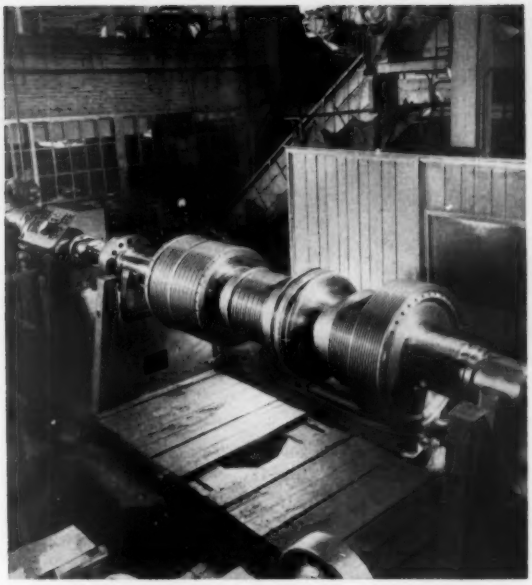
Heat straightening is actually deliberate distortion, done to bring the weldment back to the drawing. What principle is involved? Suppose a rectangular bar or structural I-beam is spot-heated (to a dull red) on one side of its neutral axis, then allowed to cool. Without pressure the beam or bar will bend. This happens because the heated metal tries to expand but the surrounding cold metal restrains it, so that it upsets or shortens. At room temperature the heat affected metal is shorter than it was before heating; this deflects the beam.

Using this principle it is possible to straighten many types of structures. Here are some examples:

During the war naval anti-aircraft gun mounts were fabricated by welding. Their base consisted essentially of fabricated I-beams—two long girders and several transverse beams. The beams were fitted to the girders and welded to them. Frequently these joints did not shrink uniformly from top to bottom and the beam was deflected upward or downward from the horizontal plane (see sketch A). When the deflection exceeded the tolerance the flange and part of the web were heated (on the side to be shortened) to bring the beam back.

The same principle can be used in straightening plates. Fairly thick plates with small bulges or bends (see sketch B) are hard to straighten mechanically. But with a calculated heating, the bulge or bend comes out easily.

KAPLAN-TYPE runner blade distorts when overlayed with stainless steel. Clamping the blade and heating it on the opposite side is the only way to correct this.



TURBINE SPINDLE bend is located by rotating it on its bearings and taking indicator readings. Spot heating on the opposite side will straighten it.

When thin metal sheets are welded to panel a structure, bulges or buckles often appear. Passenger coach outer sheets used to show this. The sheets buckled because the welds around them shrink their edges, buckling in the center. The only way to correct this was to shrink the material between welds by heating a small spot while keeping the surrounding metal cool with a water spray. The spot shrinks and draws the sheet flat.

Heavy structures can be heat straightened too. A Kaplan-type runner blade (shaped like a fan blade) is an example of successful heat straightening. The blade was several inches thick near the hub, tapering to one-inch at points around the edges. A stainless steel overlay, deposited along one edge to protect against cavitation (see photo), warped the blade. It is difficult to prevent this warpage, but easy to correct afterwards.

The blades are supported and clamped convex side up to a heavy base plate. A band is heated to shrink the upper surface to counter distortion. Several heatings may be required. The clamps and supports prevent movement of the blade during operation and increase the effectiveness of the operation.

Another large structure straightened with heat was the structural framework for a large Betatron built for the University of Illinois. This structure consists of a base with three vertical arms to support the steel-core laminations. The base was box-like, about 15 inches deep, 16 feet wide, and 24 feet long, and stiffened internally. During fabrication the arms went out of square with the surface of the base, tilting inward as much as 1¾ inches. Since the laminations were to be stacked against the inside face of the arms, the arms had to be straightened. The arms were essentially I-beams with a 3-inch thick outer flange, a 2-inch thick web plate, and a 1-inch thick inner flange. The depth of the I-section at the surface of the base was close to 12 inches.

The only practical way to square the arms was with heat (see sketch C); shrinking the 3-inch flange plate and part of the web near it. Before heating, a railroad rail was propped between the top of the arm and the opposite edge of the base. This prevented the arm from deflecting inward during heating of the outside, and increased the straightening effect. Three operators, each with a specific area to heat, used large oxyacetylene torches. After cooling, measurements showed that the arm was about 40 percent straighter than before heating. Two more applications to each arm, brought them to within the required tolerance.

Heat straightening is equally effective on structures other than weldments. Steam turbine spindles have been straightened after distorting in service. They are up to 30-inches in diameter and are machined from large forgings. When a rub bends the spindle shaft the turbine cannot be operated.

To true the shaft again, the spindle is rotated in its bearings and indicator readings are taken along the length to locate the bend (see photo). The shaft is spot-heated on the side opposite the bend, then rechecked at room temperature. It sometimes takes several applications of heat to straighten the spindle (within .001-inch runout). Although the amount of straightening is not large, great care is necessary. • •

COVER STORY

A Breakthrough For Tantalum Welding

by **BURTON PAYNE**, *manager, metallurgical department, Pfaudler Co., Rochester*

IN BRIEF: Significant advances in the techniques of tantalum production and fabrication have made this singular metal available for a wide range of commercial applications.

UNTIL RECENTLY, tantalum-lined pressure vessels could only be fabricated in small laboratory sizes. There had been two problems.

First, tantalum sheet of sufficient size for use in such construction was not available. The consumable electrode vacuum melting process made available the larger size sheets necessary and also eliminated the weld porosity which was noted when welding sheets made from ingots produced by the sintered powdered method. Initial investigations indicate that a gaseous impurity in the base metal—probably oxygen—is responsible for this porosity. Work is underway to determine the solution to this problem.

Secondly, adapting resistance welding or submerged arc welding to quality fabrication of a large pressure vessel was difficult. However, this was solved without too much difficulty once the large sheets were obtained.

TANTALUM'S PROPERTIES:

Tantalum is ideal for use in corrosive service because it is completely inert to many materials. Corrosion data for tantalum in several acids and in ferric chloride indicates little attack by these reagents except for hydrofluoric acid and hot, concentrated sulfuric acid.

Tantalum is also extremely resistant to perchloric acid, nitric oxides, chlorine (wet or dry) or chlorine oxides, hypochlouous acid, organic acids including monochloracetic, bromine (wet or dry), hydrogen peroxide, and mnay other corrosive substances. It is not recommended for use in strong alkalies, free SO_3 (as in fuming sulfuric acids), hydrofluoric acid, fluorine, fluorosilic acid or concentrated sulfuric acid (4_2SO_4) above 300°F.

It is resistant to most of the liquid metals; it is unaffected by lead, bismuth, sodium, lithium or sodium potassium alloys at temperatures to 900°C, by mercury to 700°C or gallium to 450°C. Because of this resistance to liquid metals, much interest has been shown in the potential uses of tantalum for nuclear energy systems where liquid metals are used as heat transfer media.

Besides tantalum's high resistance to corrosion, its physical and mechanical properties make it a good material for chemical equipment.

Tantalum's strength and ductility means it can be formed and shaped. It is an excellent heat conductor and thermal shock won't damage it. Because it is not an alloy, tantalum's chemical properties are always uniform. The thermal conductivity of tantalum compares to mild steel, but its overall heat transfer rates are unusually high.

Because the metal does not corrode, very thin wall scetions can be used. These thin walls present negligible resistance to heat flow.

No corrosion product film is present to resist the flow of heat. Besides, the liquid film presents a very low resistance to heat flow.

PHYSICAL AND MECHANICAL PROPERTIES OF TANTALUM

(Recrystallize Annealed)

Melting Point (°F)	5425
Density (#/cu. in.)	0.600
Vickers Hardness	125-180
Yield Strength (psi)	25-40,000
Tensile Strength (psi)	50-75,000
Elongation (%)	30-50
Modulus of Elasticity (psi)	27×10^6
Thermal Conductivity (BTV/in²/in/°F/Sec)*	0.068
Thermal Expansion (in/in/°F)*	3.6×10^{-6}

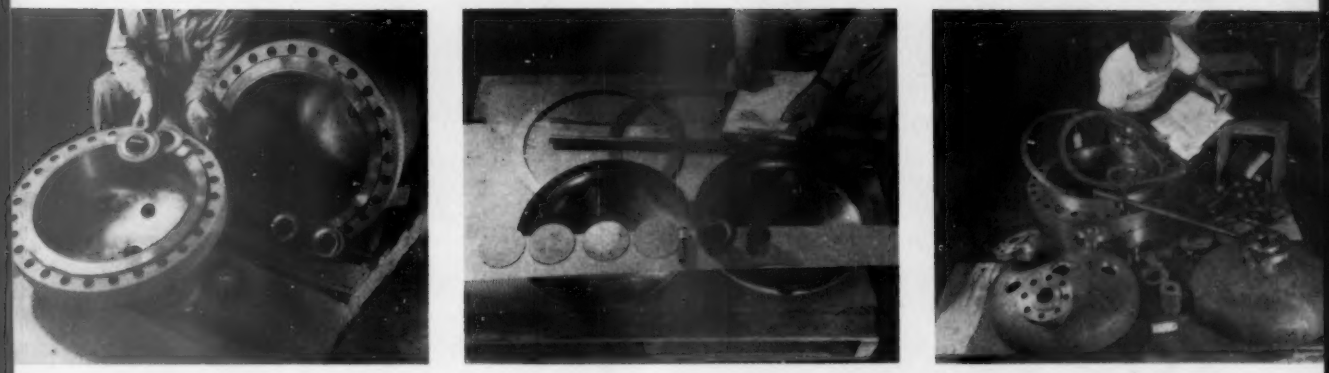
*Room Temperature values

DESIGN APPLICATIONS:

Tantalum is used successfully in the chemical industry because of its high corrosion resistance, excellent heat transfer characteristics and desirable physical and mechanical properties.

Commercial equipment fabricated from tantalum includes heat exchangers, condensers, coils, evaporator dishes, thermometer wells, dip pipes and many small accessory items. An important application for tantalum at Pfaudler is for patented repair plugs, repair patches and nozzle sleeves or liners in glassed-steel equipment. In fact, much of the tantalum heat transfer equipment listed here can be used with glassed-steel pressure vessels or columns because of the similar corrosion resistance of the two materials or construction.

In cooperation with the Haynes Stellite Company,



TANTALUM-LINED 30-gallon pressure vessel (left) is made of tantalum (center) and stainless (right)

Division of Union Carbide Corporation, Pfaudler obtained the first commercial tantalum sheets of suitable size and produced the tantalum-lined 30-gallon pressure vessel shown here.

The fabrication of this tantalum-lined reactor marks the entrance of tantalum into another important application in the chemical industry. The procedures outlined here are applicable to larger pressure vessels. Several of these are in the planning and design stage and will be in production in the next few months.

In a short time, all of the fabricated articles now available to the process industries in less unique materials will be available in tantalum.

This vessel is designed for 500 psi at 650°F. The outer shell is designed for these conditions, in accordance with the 1956 ASME Boiler Code Section. Tantalum is used only as a corrosion-resistant liner. Both the backing material and tantalum-lined accessory items are made of Type 430 stainless.

The finished vessel was actually built as two separate units. After the stainless vessel was completed, adjustments were made to insure a tight fit between both vessels. Then the tantalum top liner and bottom liner were completed except for the nozzle liners and flange face veneers. Tantalum liners were fitted into the stainless vessel. Tantalum nozzle liners were inserted into the stainless steel nozzles and then welded to the tantalum head liner. The tantalum nozzle flange veneers were then welded to the tantalum nozzle liners.

To get good drainage a somewhat different approach was used for the bottom outlet nozzle. The bottom head was spun down to meet the nozzle liner, using a generous radius to assure drainage. The nozzle was welded to the bottom head prior to inserting the liner into the stainless vessel. The bottom nozzle flange veneer was welded to the nozzle liner after it had been inserted. This procedure is not possible with top head nozzles, except for the center nozzle, as the others are normal to the head and not on the horizontal axis of the vessel. If the tantalum nozzle liners were welded to the top head liner outside the stainless vessel, it would be impossible to insert the tantalum liner into the stainless top head. The final operation consisted of adjusting the tantalum shell and then welding on the tantalum main flange veneers.

WELDING TECHNIQUES:

In welding, tantalum will react with atmospheric gases and become brittle. It will also alloy with other metals with resulting low ductility if there is contact with other metals during welding. There's another welding problem: The high melting point of tantalum, and the thin sections used. Thicknesses of 0.010- to 0.040-inch are commonly used. The comparatively high welding currents necessary to melt the materials are capable of burning through or melting a hole in the weld joint if the proper joint preparation and fit-up are not followed. Quick chilling of the thin material is also necessary to avoid distortion or bending.

Currently, there are three methods of welding tantalum. A fourth experimental method may be eventually used in certain applications. The methods currently used are resistance welding, submerged arc welding under carbon tetrachloride and tungsten arc inert gas welding. The experimental method is electron beam welding under a vacuum. Thorough precleaning and good joint fit-up is essential to all methods.

In resistance welding, two surfaces are placed together in a lap joint. Then shaped electrodes are pressed against each side. When a current is passed between these electrodes through the tantalum, the metal is heated due to its inherent electrical resistivity. A specified pressure is applied at the proper time to make the weld.

Thin sections may be welded in air or inert gas, but thicker sections must be welded under water. Prevention of a reaction with contaminating gases and a quick chill of the weld are obtained because of lower temperatures and shorter times. However, the resulting weld is not as satisfactory as a butt weld (square groove) from a strength and design standpoint. In addition, a certain amount of tantalum is sometimes wasted.

TWO TYPES of chambers used in welding tantalum are flow purge (left) and vacuum purge (right).

TANTALUM WELDING *Continued from page 37*

In submerged arc welding a carbon electrode is used with the work in a carbon tetrachloride bath. The edges to be joined are placed parallel in a flanged lap-joint and the weld is made. Suction hoses are used to draw away fumes.

Protection from air and the quick chill are achieved at the expense of carbon pick-up in the welds. This carbon pick-up results in somewhat lower ductility and corrosion resistance. An advantage of this method is that it can be used in welding complicated parts for which mechanized welding is not applicable. Tungsten arc inert gas welding, however, has this same advantage without the other disadvantages.

Tungsten arc inert gas welding is the most versatile method for welding tantalum. It has no inherent disadvantages other than the fact that it is more difficult to learn and apply, and takes more preparation to provide good protection and quick chilling. It is adaptable to either mechanized or free hand welding. Filler rod may be used if necessary. All joints shown (except the spot welded lap joint) can be made. The arc is struck between a tungsten electrode and the work piece, and precise control of all variables can be achieved. Pure tantalum filler wire is easy to use and gives excellent results.

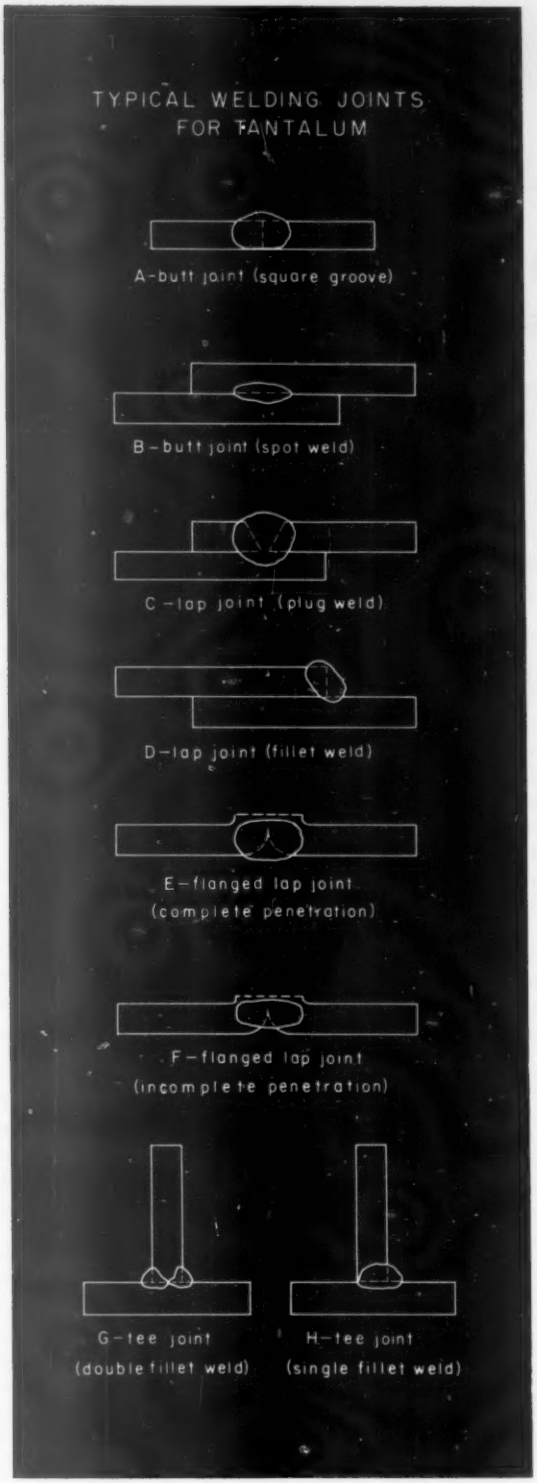
When a butt welded joint is used without filler metal, the weld has the same thickness as the base material. If filler wire is used, or a flange lap weld is used, complete penetration with reinforcement on both sides of the weld can be achieved if desired. This method is very suitable for mechanization with standard equipment, but only after careful preparations have been made for gas protection. Protection is achieved by using a trailing shield which follows the torch and protects the weldment until a safe temperature has been attained.

Chamber welding is possible.

In a flow purge system, work is placed in a chamber, or a chamber is constructed around the work if the size of the work warrants it. The correct atmosphere is achieved by flushing inert gas through the chamber and forcing air out. Or, a collapsible chamber is used and alternately filled with inert gas and collapsed to get correct atmposphere. After proper atmosphere has been established, standard techniques are used to make the welded joints. The torch and arms of the operator must, of course, be within the chamber. The flow purge method is good for field repair work.

A vacuum purge chamber gives the finest inert gas atmosphere you can get for welding tantalum. Work is loaded into the welding chamber which is then evacuated to a predetermined vacuum. The evacuated chamber is then back-filled with inert gas. Rubber gloves which extend through the sides of the chamber are used to facilitate the physical movements necessary to complete the weld. Standard welding equipment is used within the chamber. Our company, the world's largest manufacturer of industrial glassed-steel equipment, recently installed such a vacuum purge inert gas chamber. Mechanized equipment now being designed for use inside the chamber will assure optimum conditions for gas protection and welding efficiency in many cases.

Electron beam welding of refractory metals has been used experimentally. The work piece is positioned in a welding chamber and a vacuum of less than 0.1 micron is drawn in the chamber. An electron beam gun is used in place of the tungsten arc inert gas torch and the resulting weld is the finest possible as far as weld purity and lack of contamination are concerned. However, all apparatus must be mechanized. And, adjustments in the work piece are difficult to make after the chamber has been pumped down. In addition, initial equipment investment is extremely


TYPICAL WELDING JOINTS FOR TANTALUM
A-butt joint (square groove)
B-butt joint (spot weld)
C-lap joint (plug weld)
D-lap joint (fillet weld)
E-flanged lap joint (complete penetration)
F-flanged lap joint (incomplete penetration)
G-tee joint (double fillet weld)
H-tee joint (single fillet weld)

high. This extra expense for the sake of super-purity cannot often be justified in the chemical industry.

After electron beam apparatus has been proven commercially, however, there may be applications in supercritical services such as in the fields of atomic energy, rockets and missiles that will justify its use. ••

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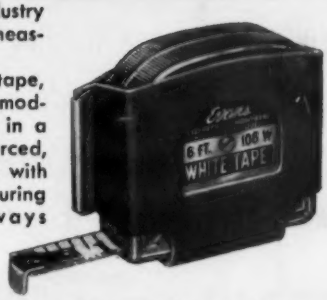

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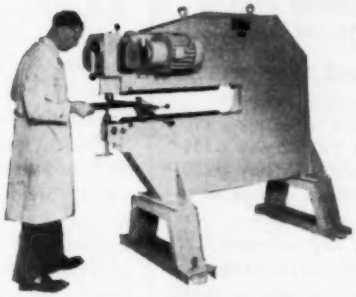

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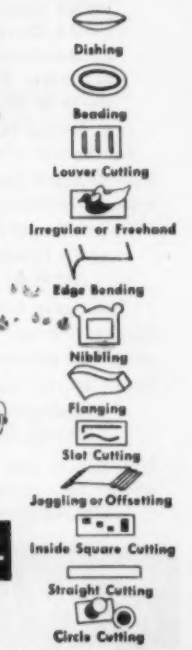

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For More Information Circle No. 62

Can steel replace titanium in missiles?

WELDED STEEL SPHERE has an unusual weight-pressure ratio.

IN BRIEF: This company builds steel containers at one-fourth to one-third the cost of titanium, yet offers weight savings normally associated only with titanium.

CONTRARY TO GENERAL PRACTICE in the weight-conscious missile industry, a highly-classified major missile probably will go into tactical production with steel high-pressure pneumatic containers, instead of titanium.

"We are able to offer weight savings normally associated only with titanium, at one-fourth to one-third the cost of a comparable titanium vessel," reports R. H. LaFontaine, chief engineer for Tavco, Inc., Ltd., Santa Monica, Calif., designers of fluid and pneumatic control equipment.

He said that his company is in limited production of an alloy steel (4340) welded sphere that has a diameter of 16.5 inches, an internal volume of 2300 cu. in., and weighs only 27.5 lbs. It is designed for a minimum burst pressure of 6000 p.s.i., and a normal operating pressure of 3150 p.s.i. Endurance characteristics are said to compare favorably with conventional, much heavier, steel vessels in the temperature range of —65 F. to +350 F.

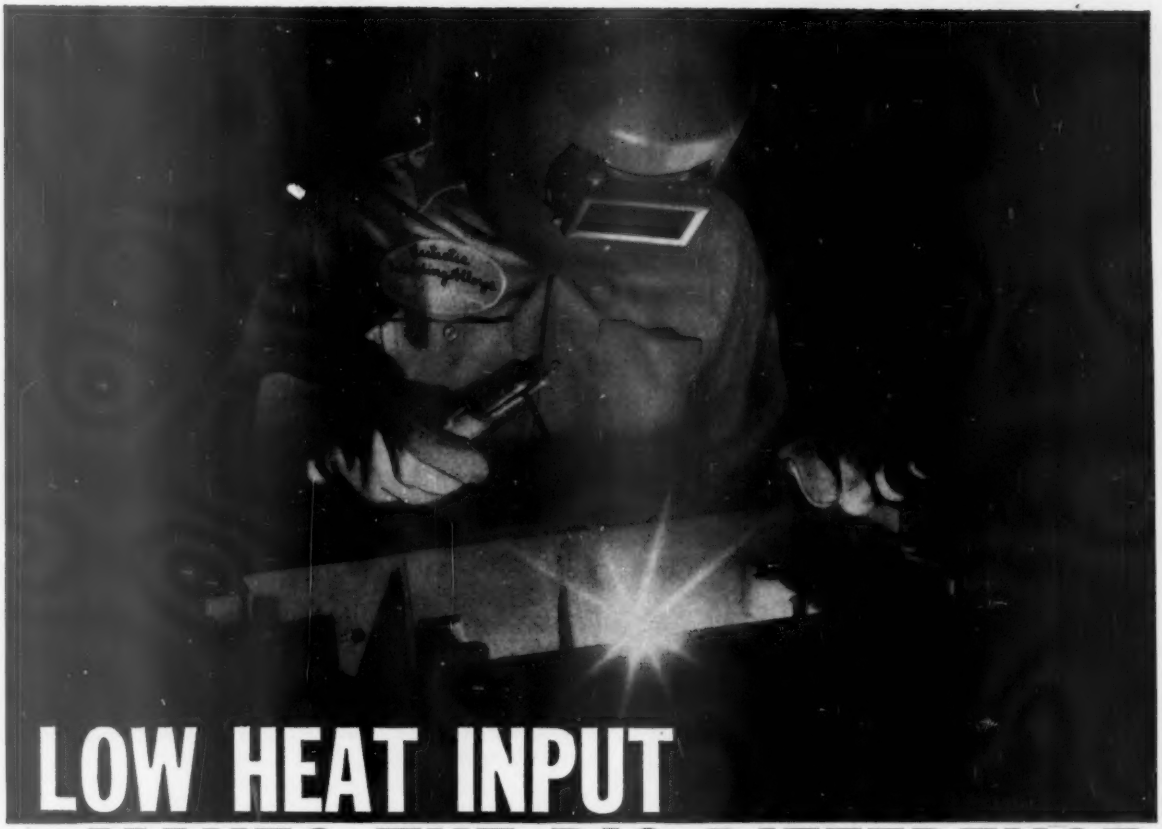
Reluctant to disclose fabrication techniques in detail, Tavco's engineer says that the secret of achieving an unusual weight/pressure ratio for the vessel lies in heat treatment and application of its tungsten arc weld. The steel is heat treated after fabrication to a minimum tensile strength of 260,000 p.s.i. Heat treatment requires approximately 48 hours. Welding is done with hand-fed wire, in the open, using an argon/helium purge of the work area.

Although spin shaping has gained a commanding position in the forming of missile nose cones and low-pressure containers, Tavco reports that it cannot be applied to hemisphere contouring of the steel sphere in question.

Fabrication begins with 1/8 inch 4340 sheet stock that is reduced by precision grinding, and finally buffing, to required thickness. The ground surface must be devoid of grind scratches, and spin forming would produce surface abrasion that would destroy smoothness requirements for the finished article. For hemispheres up to 13 inch diameter Tavco shapes by hydro-forming, and for larger diameters shapes on a hydropress.

Tavco has expressed considerable interest in chemical milling as a means for thickness reduction of original steel stock. It should reduce gouge rejects encountered in grind reduction, although the cost probably would be twice that of the grinding technique.

LaFontaine says that success in use of the 4340 alloy has prompted preliminary research in its use for containers meeting military requirements for sub-zero temperature range. "From recent experience we have reason to believe that this alloy may be able to exceed materially its accepted minimum temperature rating of —100 F.," he said. "We believe it might perform at —320 F. And, if this is the case, it will open a new field for competition with Inconel-X (—297 F.) containers, such as are aboard the X-15, through cost reductions." • •



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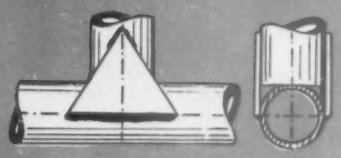
Part 2*

Design Hints For Using Welded Tubing

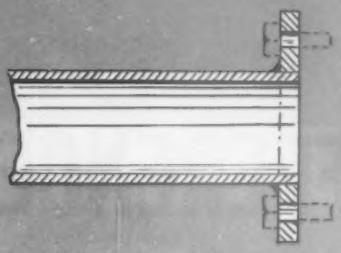
WELDED STEEL TUBING can be welded readily because it is made from the most weldable grades of steel. Joint design and tubing wall thickness are the two most important factors in determining which welding method to use.

This report covers the common arc, gas and brazing methods used to join one tube to another or to join a tube to another metal form. • •

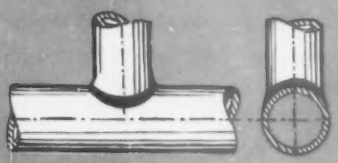
ARC AND GAS WELDING



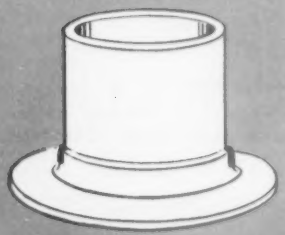
Gusset plates may be welded to both tubes to produce a side weld.



Flanges are welded at or near the end of the tube.

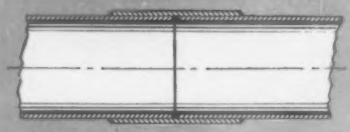


Side welds are made by forming end of branch tube and welding continuously.



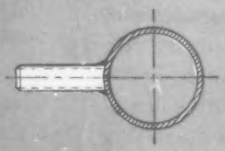
Weld both ends of a split stamping together and to the tubing simultaneously.

BRAZING

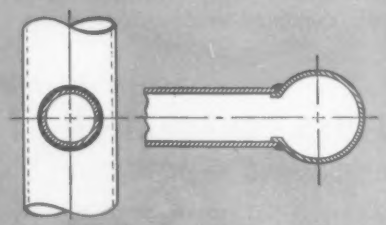


In making a sleeve joint, molten brazing alloy is drawn into the joint by capillary attraction.

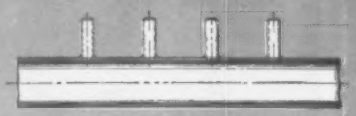
More than one stud, hanger or bolt can be brazed to a tube in this manner.



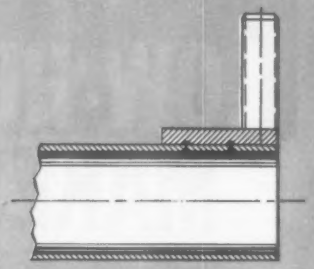
Branch connections are made by placing brazing alloy ring around the branch tube and heating in a high frequency induction furnace.



WELDING STUDS

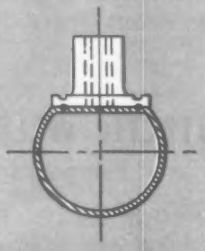


Tubular studs (ID or OD threads or no threads) are welded to tubing to produce a manifold.



Nibs can be formed on the base of the stud or on the tube; then stud is projection welded.

Two solid studs can be resistance welded to tubing diametrically opposite each other.



Tube which receives a stud is flattened; stud is placed and welded. This applies either to ID or OD threaded studs.

*Part 1 in July covered methods for spot and projection welding of welded tubing.

What Designers Should Know About Welded Steel Construction

by **CHARLES I. ORR,** *district engineer, American Bridge Div., U. S. Steel Corp.*

IN BRIEF: More specific details are required when designing a welded structure than when designing for a riveted or bolted job.

THE USE OF WELDING for connecting the various parts of a steel building or bridge has been the subject of considerable discussion and even controversy. Some individuals promote the use of welded connections with great enthusiasm. Others resist such use with equally great stubbornness. However, most design engineers approach this problem just as they would any other engineering problem in an open-minded, analytical manner. They use welded joints where they are applicable and advantageous. And, they discourage their use where other types of connectors can be better.

Actually, the joining of structural members by welding is a simple process when compared to making complex weldments from a variety of ferrous and non-ferrous materials. In structural welding we are concerned primarily with short welds, simple joint arrangements and mild carbon steel material. Therefore, there are relatively few problems in making a satisfactory welded joint between structural members.

The use of welding provides us with just another method of connecting two or more pieces of steel to each other. This process does not require any basic change in the fundamental science of structural analysis. It is true that it is often much easier to provide rigidity in welded joints than in riveted or bolted joints. This natural rigidity is one of the greatest inherent advantages of welded joints. When two or more members are fused together by welding, they become one integral member.

Design of all component parts of a welded structure is the most important part of the job. substantial difference between drawings for a riveted or bolted job and for a welded job. The outstanding difference is the extent of detail required.

DESIGN AND DRAWING REQUIREMENTS

Due to the lack of standardization for welded joints, the drawings for a welded structure must show complete information if work is to be done as visualized by the structural engineer. Designers and detailers of welded structures should become familiar with the American Welding Society's standard symbols. These can convey the exact information needed.

Provide specific details for each connection. Show the size of all detail material and welds. This detail information can often be simplified by the use of job standard details together with accompanying schedules.

ECONOMY

Welded details should be kept as simple as possible. The designer of welded structures should disregard practices and details previously used for riveted joints. Gusset plates, splice plates and similar fittings are not usually necessary in welded construction.

Parts should be designed and detailed to provide good accessibility for fitting, for welding with electrode in proper position and for operator's visibility.

The relative size of welds is also a major consideration. A 3/8-inch fillet weld requires two passes or almost twice as much labor as a 5/16-inch fillet weld. But, it requires 40 percent more weld metal and is only 20 percent stronger.

The welded base plate, a typical example of simple welded construction, is all too often over welded. Base plates are welded to column shafts to resist calculated movement (shear or uplift or a combination of these

CHARLES I. ORR was engaged in structural engineering and architecture from 1928 to 1935. He was engineer and chief draftsman with a steel producer and steel fabricator from 1935 to 1940. From 1940 to 1946 he was supervisor of civil engineering, structural engineering and architecture for B. F. Goodrich Company, Akron.

He joined Consolidated Western Steel Division, United States Steel Corp., Los Angeles, where he became assistant chief engineer. He was transferred to the American Bridge Division, USS, as Los Angeles district engineer in 1955 and then to a similar position in American Bridge's New York Office.

Mr. Orr is professional engineer and is a member of the American Welding Society and the American Society of Civil Engineers. He is a member and sub-committee chairman of the American Welding Society's Building Code Committee. He is a member and former chairman of the Committee on Specifications of the American Institute of Steel Construction.

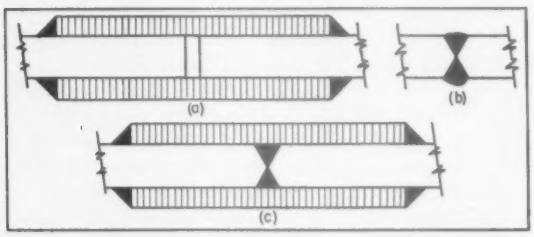
DO'S AND DON'TS FOR DESIGNERS

1. Do specify the minimum amount of weld that will satisfy governing conditions.
2. Don't over weld. Don't use the all around symbol promiscuously.
3. Do keep welded joints simple in design. Design for downhand welding when possible.
4. Do design joints for welding. Don't design joints for riveting and then note them to be welded.
5. Do take into consideration standard mill tolerances of rolled shapes and what effect they may have on the detail. Don't use details which depend on such shapes being perfectly square and to exact dimension.
6. Don't use a direct butt weld and a splice plate on the same joint for the same purpose. Do use one or the other, not both.

factors) or just to stick the thing in position so it won't be misplaced. The weld required for any of these, except perhaps the last one, can be calculated.

However, it is much easier to call for a weld of generous size by adding a little circle to the welding symbol which says "weld all around".

For example, the base plate for an 8 WF 31 column (total "all around" dimension of 48-inches) may be welded in place by four 2-inch (a total of 8-inches) welds. There is no more reason to double the required size of the weld than there is to double the size of the column shaft or of the base plate.



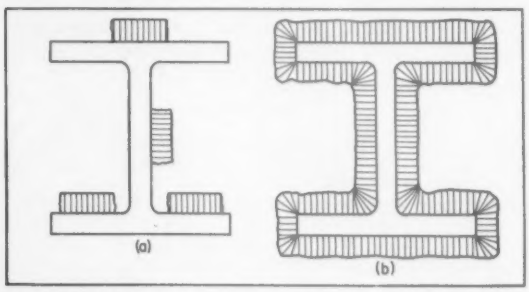


FIGURE 1 (top): Splice two members with splice plates (a) or with a butt weld (b), but not with both (c). (b) is preferred.

FIGURE 2 (bottom): Base plate for column may be held securely by four 2-inch welds (a). Needless "all around" welding would require 48-inches (b).

The position of the weld is also important. In its normal progress through the shop, an H-section is placed on stands with its web vertical. With the H-section in this position it is simple to attach our base plate by making a downhand weld on the outside of the top flange and on the inside of the bottom flange. While the section is still in this position, a vertical weld may be made on one or both sides of the web.

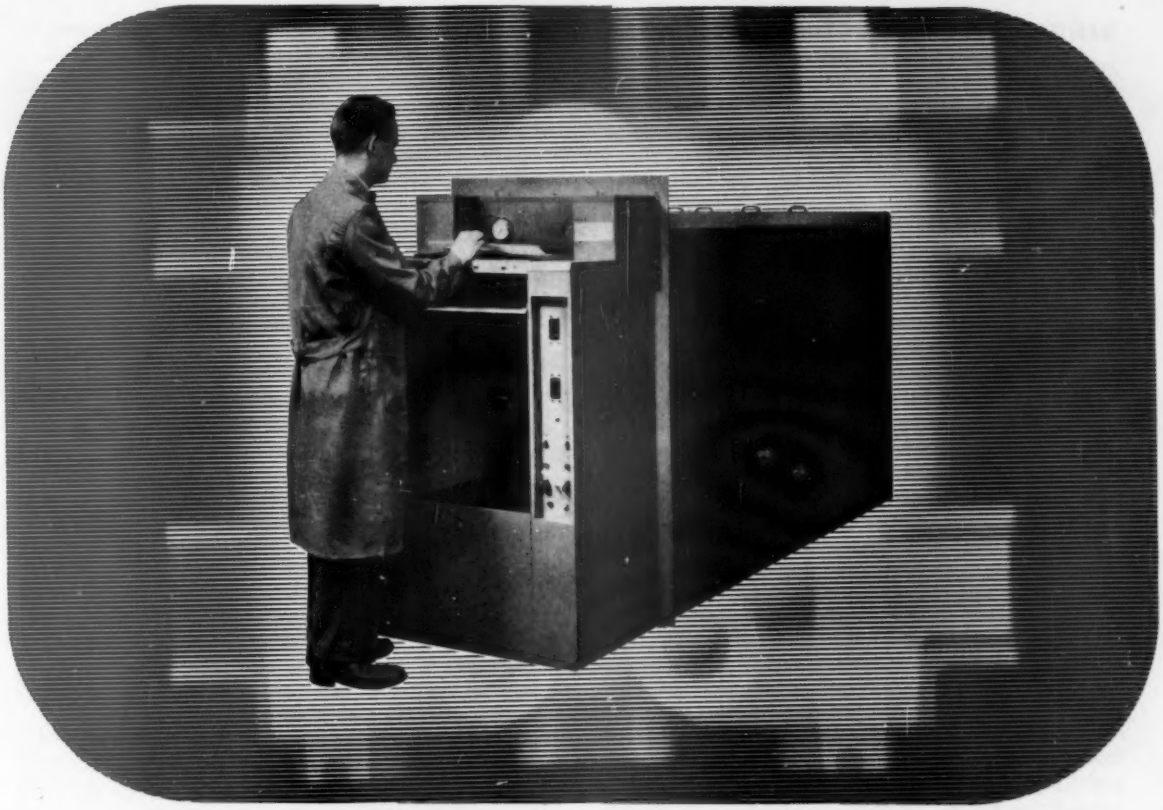
If welding on opposite sides of the flanges is required, either the column section must be turned over or overhead welding must be used. Both cost money.

SPECIFICATION REQUIREMENTS

Specifications can usually be very simple. The "Standard Code for Arc and Gas Welding in Building Construction" and the "Standard Specifications for Welded Highway and Railway Bridges" of the American Welding Society are almost universally accepted. These can be incorporated in the specification by reference. The Bridge Code was revised in 1956. However, the revised edition of the Building Code has not yet been issued. The material preparation for joints shown in the Bridge Code can often be used advantageously in building construction. Some of the stricter requirements of the Bridge Code may be applied in building construction in critical areas, particularly where impact or vibration are present.

The job specifications should also list the qualifications of or additions to the AWS specifications previously mentioned. For instance, either the specifications or the drawings should definitely state whether butt welds are "incomplete penetration" or "complete penetration" and should specify definite inspection requirement. Specifications should not impose unnecessary or impractical restrictions relative to materials, procedures or inspection.

continued on page 46



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DESIGNING FOR STRUCTURAL WELDING

continued from page 44

Material specifications have been a subject of considerable discussion for several years. By far the greater percentage of steel used in structures has been produced under A.S.T.M. Specification A-7. Practically all building codes require that structural steel conform to this specification. However, this specification does not provide a maximum limit for carbon content. Since steel becomes progressively more difficult to weld as the carbon content increases, this lack of control of carbon content in A-7 steel has been a matter of concern to engineers and welding technicians. Federal Specification QQ-S-741 Type II provides for a structural steel with definite maximum limitations of carbon content and is for use in welded construction. In 1954, A.S.T.M. issued Specification A373 which is essentially the same as QQ-S-741. Therefore, we now have a universal standard specification for steel designed for welded structures.

These later specifications offer technical advantages. But, at times they do create availability problems. Because of the great variety of shapes and sizes of members required for steel structures, it is difficult for the fabricator or warehouse to maintain adequate inventories under even one specification. It is therefore reasonable to assume that local stocks will generally be limited to A-7 steel. Steel under Specification QQ-S-741 and A373 must usually be mill-ordered. It is recommended that the use of these specifications be limited to steel that can be mill-ordered, that is with respect to the time element and minimum quantities.

The carbon content of A-7 steel in members less than one inch thick is normally within the maximum limits required by the later specification. It would therefore appear desirable to continue to use A-7 steel for "out of stock" jobs. This material can be tested to determine carbon content if the control of chemical qualities is desirable for certain critical elements. The minimum tensile strength of 60,000 psi specified in A-7 is reduced to 58,000 psi in A373 and the minimum yield point is reduced from 33,000 psi to 32,000 psi.

RELIABILITY OF CONNECTIONS

The design engineer must have confidence in the method of connection he specifies. Repeated tests and the performance of structures have shown that the normal welded joint is stronger than the base material. It is reasonable to assume that good welding will be obtained when sound regulations, such as contained in the American Welding Society Codes, are followed by a competent organization. The allowable working stresses, specified by code, include an ample factor of safety so there is no need to use excessive quantities of weld. • •

NEXT MONTH: The author concludes his article on design hints for structural welding with a discussion of quality control. He explains how this important subject affects both designers and fabricators. He also explains the function of an inspection agency.

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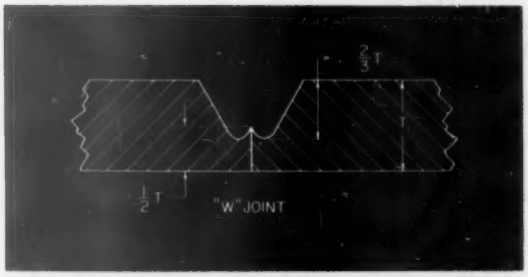

A J-LIKE TROUGH is machined around each part. When parts are assembled and held with simple end pressure, the joint resembles a "W" with a low center point.

THE NEW JOINT ELIMINATES costly backup mandrels, like the one used for this cylinder welding application. It also simplifies preheating, and reduces rejections.

Location of Hardness test	Results Knoop Hardness No.	Rockwell "C"*
Center of weld deposited nugget	433	42.5
Heat affected zone on either edge of nugget	377 to 290	38 to 27
Parent metal	256	21

*Approximate values . . . for comparison only.

GRADIENT MICROHARDNESS TESTS taken across a section of AMS 6434 alloy steel welded with the W joint process show that embrittlement is negligible.

New "W" Joint Eliminates Costly Tooling

IN BRIEF: A new joint has been developed for round-about welding of thick-walled, medium alloy steel cylinders, tanks and spheres; it eliminates costly tooling, lowers labor and rejection costs.

NEW JOINTS are always welcome. Here's one developed by Airline Welding and Engineering, Hawthorne, California, for roundabout welding of thick-walled, medium alloy steel cylinders, tanks, hemispheres and spheres. The design eliminates costly mandrels or complicated tooling or consumable inserts. It simplifies preheating, lowers labor and equipment costs, and reduces loss due to rejected parts.

A J-like trough is machined around each part so that its outside edge is about half the thickness of the metal, and the root two-thirds (see sketch.) When butted, the joint resembles a W with a low center point.

The parts are held together with simple end pressure and a 1-inch band on either side of the joint heated to 500°F. First, the W's low center is fused by tungsten inert arc; then an inside weld penetrates it. The joint may then be completed by the same process, or by the consumable shielded arc or submerged arc processes. The result is a 100-percent weld with uniform penetration and a smooth, easily-controlled contour. There is little chance for drop-through.

The new design avoids the drawbacks of the conventional V joint. One V-joint drawback is that the walls crowding the root absorb the arc heat. This, combined with the deposit, impedes arc penetration. With the new design, the arc is concentrated at the W's center peak but far enough away from the walls to nearly eliminate heat absorption.

Tests prove there is little embrittlement in joints welded by the new process. Airframe Inspection Inc., South Gate, California, made gradient microhardness tests on a welded section of AMS 6434 steel to do it. The section was preheated to 500°F, tungsten arc welded, and slow cooled from 650° to 100°F. within four hours. Airframe used a microhardness tester with a load of 500 grams on the Knoop diamond indenter. They took an average of five readings. • •

RUSSIAN WELDING *continued from page 28*

a great extent on the reliability and efficiency of the welding of the modern heat-resisting steels in boilers and turbines.

We know that serious difficulties, connected with the proneness of the weld metal to cracking both during welding and under load were encountered with the first 150 MW steam turbines, and in the welding of thick-walled steam tubes and steam super-heater tubes made of austenitic steels. Soviet welding engineers must try to overcome these difficulties. They must collaborate with metallurgists to work out a reliable welding procedure for heat-resisting steels. Attention must first be paid to the production of the so-called precision austenitic electrodes, manufactured from steels and alloys which are spectroscopically free from gases and injurious low-melting impurities.

The seven-year plan is based in the instructions of the central committee of the C.P.S.U. dealing with the over-riding need to develop the oil and gas industries in order further to improve the country's fuel balance sheet. The plan forecasts the provision of oil and gas not only for communal and living necessities, but also for industry, including power stations, and rail and water transport. This means that output of equipment and apparatus for the oil and gas refineries will increase greatly, and that the construction of various types of containers for oil, gas, and refinery products will expand; finally, the lengths of the main oil, gas, and refined product pipelines will increase many times. Here, too, our welding industry is destined to play an important part.

It is the task of Soviet welding engineers fully to mechanize welding work on new pipe lines, and to improve the welding techniques used in the engineering works supplying the oil and gas industries with the latest equipment, also in the works producing large diameter welded tubes for main pipe lines, as well as the tanks and other containers used for storing oil and gas.

The great increases in the planned output of steel, aluminum and other metals, and correspondingly in the scale of metal working, make the present shortage of metal particularly acute. As we know, welding techniques enable much to be done in that direction. We are not referring only to the wide adoption of the hard facing of worn parts, or to the manufacture of bimetallic articles with a comparatively thin working layer of alloy with the specified properties. We must develop work on the further rationalization of welded structures, and on the improvement and perfection of the methods by which these structures are designed and built, using metal as economically as possible, and making use of its properties to the full.

The time has come decisively to improve the design of welded structures; for this purpose, serious attention must be paid to improving the qualifications of structural engineers, and also to the training of fresh teams, familiar with welding techniques, and able to design reliable, efficient structures of minimum weight.

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and the Government concerning the reorganization of higher school work, it is relevant here to dwell on certain problems of the training of teams of engineers for the welding industry. The measures which have been laid down to make higher school education more practical will undoubtedly help to improve the training of welding engineers. There are however still a number of specific points which urgently require solution, namely the syllabuses for the training of welding engineers.

At the overwhelming majority of universities in our country welding engineers are trained at the mechanical faculties, where future specialists are taught about machine parts, theoretical mechanics, the theory of machines, technical draughtsmanship, descriptive geometry, etc. The student not only learns about and designs hoisting plant and machinery, but he is taught sufficient about the science of metals. On leaving an institute, a graduate receives the title of welding engineer-mechanic, but actually he is more a mechanic than a welding engineer.

In such conditions, a welding engineer must have a profound knowledge of metallography and metal physics, including the heat treatment of metals, the metallurgy of various steels and alloys, physics, chemistry and physical chemistry. However, the necessary attention is not being paid to these subjects at the mechanical faculties. It has now become necessary to pay considerably more attention to the study of the metallurgical process. Only on this condition will our industry receive teams of engineers capable of improving Soviet welding techniques. ••

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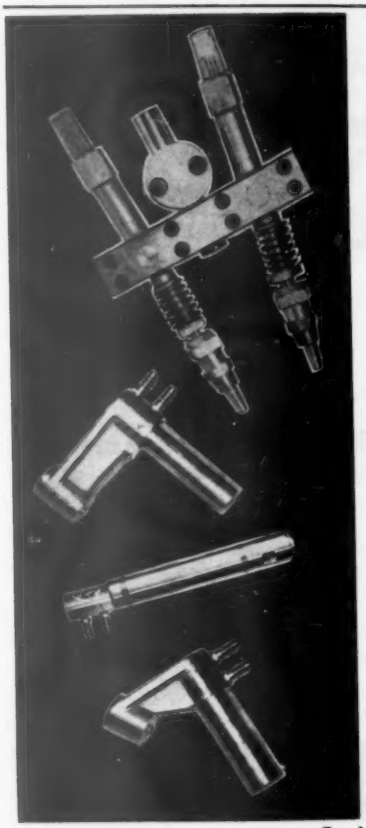

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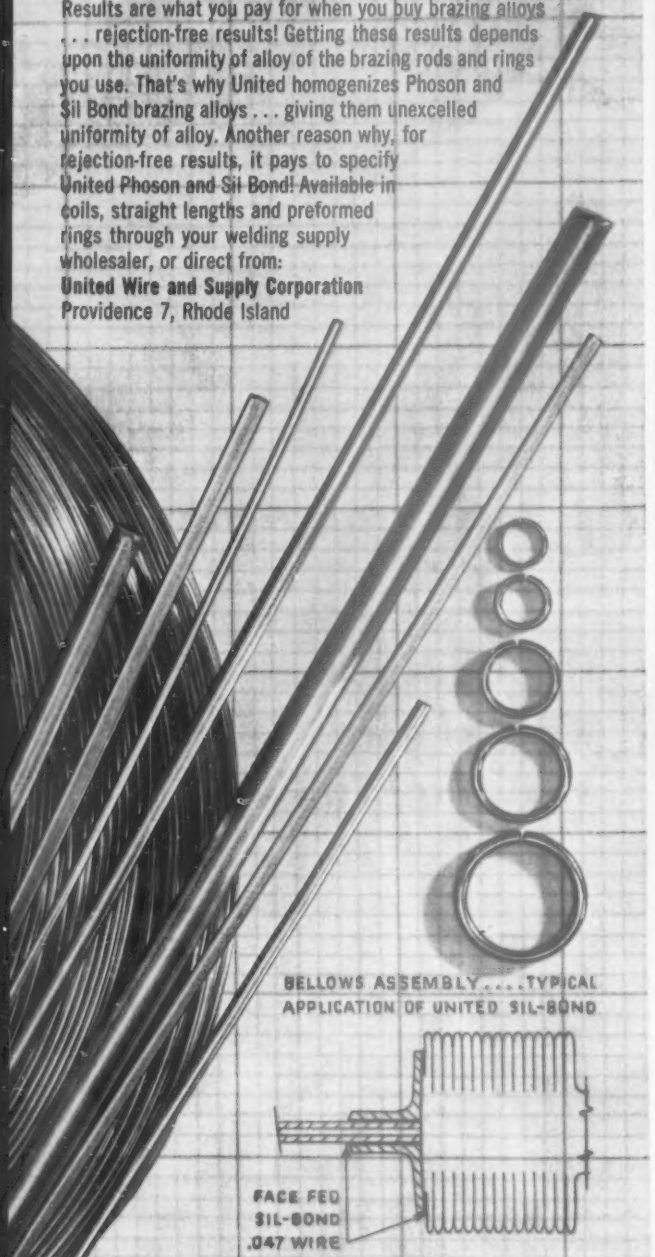

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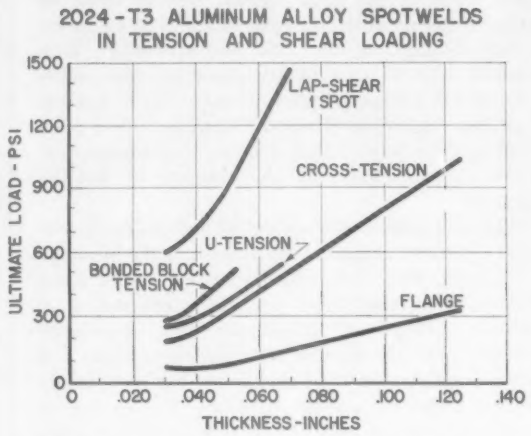
PEEL TESTING *continued from page 31*



GRAPH A: Strongest welds are those of the standard lap-shear specimen.

The second was to utilize one of these test joints for comparative purposes. The standard cross-tension test was picked. This single test was useful for machine setting development, weld quality, post heat treating and material weldability comparisons.

Figure 3 shows a series of test configurations selected. They have been plotted in their order of increasing peel resistance.

The weakest joint starts at the left. This type joint

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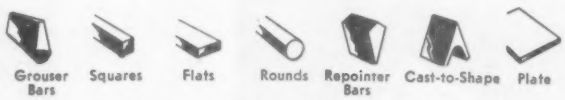

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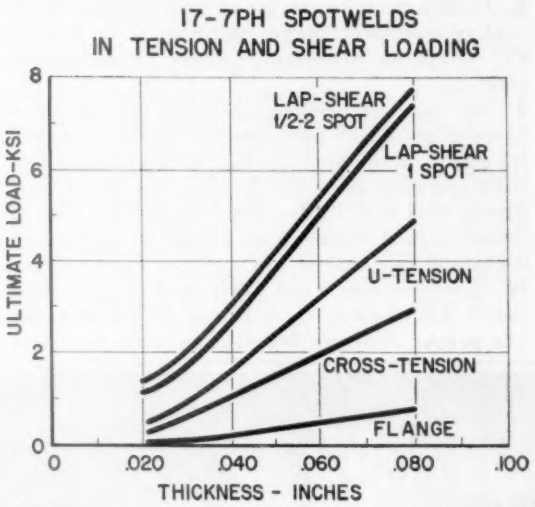
rarely exists in structures. As peel resistance increases to the right, one finally gets to the bonded block tension; this is the closest we have been able to approach pure, normal tension.

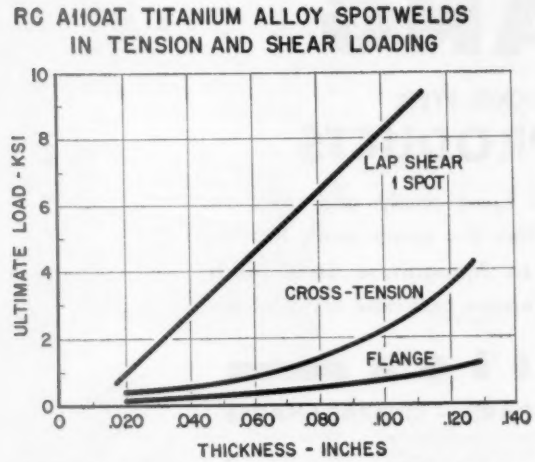
Graph A shows a relative peel severity on the bonded-block tension, U-tension and cross-tension.

Let's look at some of the test results. Graph A shows the first tests which were run with 2024-T3 aluminum alloy. The strongest welds are those of the standard lap-shear specimen. The weakest were the double flange spot welded specimens.

In between these two conditions are plotted the strengths of the other specimens. Notice that the bonded block tension specimen only tested up through approximately .055-inch. This shows good correlation and falls in the theoretical range of tension strengths.



GRAPH B: It was not possible here to get a bonded block tension specimen to stick.



GRAPH C: Curves show the decided peel-sensitivity of titanium alloys.

Graph B illustrates the same type of tests on 17-7 PH spotwelds. Graph C shows the same test configurations with aluminum-tin titanium alloy. • •

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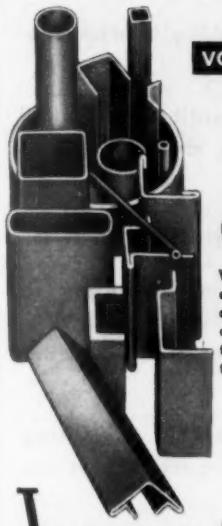

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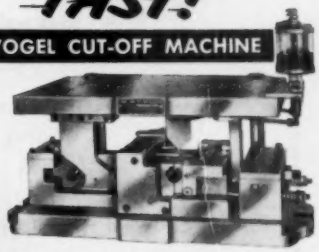

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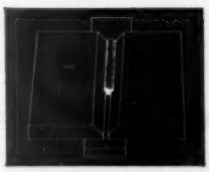


Easily removed when weld is completed

- Less skill required to produce better welds
- Heat engineered to withstand high arc temperatures
- Speed production—Lower fabrication costs
- Minimize weld failures—Insure proper root fusion
- Produce smooth, uniform bead on under side

Call or write today for illustrated bulletin on Pyrotone ceramic backing materials. Literature includes application data and full details.

General Ceramics Corporation
GENERAL CERAMICS
Industrial Ceramics for Industrial Progress...Since 1906
KEASBEY
NEW JERSEY
Telephone:
VAlley 6-5100

For More Information Circle No. 27 on Reader Service Card.

WHERE TO USE MILD STEEL FILLER METALS

TYPES	APPLICATIONS
Bare	Gas welding, build-up or repair
Cellulose	Tackwelding, piping, field welding, structural, pressure vessels
Rutile (titania)	Farm equipment, structural
Low hydrogen	Earth moving equipment, pressure vessels, sulfur steels, enameling stock, high carbon steel
Iron powder	Comparable to coating counterparts without iron powder
Iron oxide	Pressure vessels, machine bases, large structures

FILLER METALS *continued from page* 33

would have to be reworked. It is quite possible that the porosity will not impair the joint's function in service, but research data is not available to prove this. Of course, E6012 electrodes are normally used for single-pass work; there is no porosity when they are.

6. How does the electrode selected handle in the position in which it will be used? This is an important question. Experienced operators know better than to weld overhead with E6020 or E6030 electrodes. They'd be showered with hot sparks.

7. Electrodes have to match a joint and its fitup. E6020 or E6030 electrodes are ideal for downhand welds in V- or U-grooves. A square butt joint would probably be welded best with deep-penetrating E6010 electrodes. Where there is a gap, an a.c. electrode may be the ticket.

8. Another thing you've got to keep in mind is the welding equipment. Some electrodes work best on a.c., others on d.c.-reverse polarity or d.c.-straight polarity.

9. Nor can you overlook operating characteristics. Large shops usually have operators of different skill. It's a good rule to supply the least skilled with the most stable-operating electrode—he'll do the fastest, best quality work with it. And don't forget cost. Rate of deposit, deposit efficiency, the amount of spatter, and the ease of slag removal, are important checkpoints.

10. How much does it cost to deposit a pound of weld metal? You've got to know. If time studies show that iron powder electrodes deposit more metal than other

TISCO®

TIMANG®

MANGANESE-NICKEL STEEL

WELDING PRODUCTS

Timang Manganese Welding Rod fuses easily and does not weaken the parent metal. Weld has the same work hardenability and wear characteristics as Manganese Steel. Rods, Bars, Plates, Etc. are excellent for repairs and new installations.

WELDING RODS — PLATES — BARS — SPECIAL SHAPES

TAYLOR-WHARTON CO. DIVISION OF HARSCO CORPORATION HIGH BRIDGE 10, NEW JERSEY

PLANTS: Cincinnati, O. — Birmingham, Ala. — Easton, Pa. SALES OFFICES: New York — Chicago — San Francisco

For More Information Circle No. 58 on Reader Service Card.

electrodes, use them. Sometimes the costliest filler metal will produce the most. Sometimes the cheapest electrode will do the best. • •

NEXT MONTH: The author concludes this series with a factual discussion of the non-ferrous filler metals, the important surfacing metals and tungsten electrodes. He tells where, how and why they are used.

1500 LB. OVERLAY *continued from page 29*

minum bronze overlay.

We preheat the ram to 300°F for two reasons. For one, we're working with a large mass of fairly-high-carbon steel. We can't chance cracking. Second, the aluminum bronze flows better at this heat. Air-gas flames play on the ram while it slowly turns in the lathe. Temperature-indicating sticks touched to the steel tell us when it's hot enough.

With this 2-head machine one operator, watching and controlling welding from his scaffold perch, can deposit 150 pounds of metal in 8 hours. In 10 shifts, we lay down the needed 1,500 lbs. of aluminum bronze. We do it in three, ⅛-inch thick passes.

When the first torch overlaps the starting deposit of the second, we reposition torches so that the first picks up where the second left off. Then we weld until the deposits over-lap. When they do, the layer is done.

After welding all that remains is machining. When the true diameter is obtained the ram is ready for installation, then long, long press runs. • •

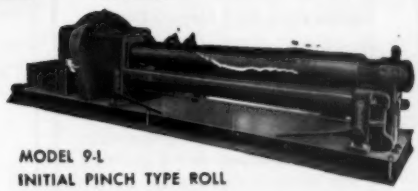
Get the lion's share of meaty facts out of this issue of WELDING DESIGN & FABRICATION before you pass it along to the next reader. Leaf through once more: If you want full details on any item, the Reader Service Card will bring them to you quickly. No postage needed.

WEBB PLATE FABRICATING MACHINERY

PLATE BENDING ROLLS

The Webb Corporation offers a complete line of Plate Bending Rolls for the rolling of the thinnest plate up to plate 2½" thick. Offered in a variety of lengths and thicknesses. Constructed for the modern fabricating shop.

Two types available: the Initial Pinch Type and Pyramid Type machines. All latest advantages of today's modern machine tools are incorporated, utilizing anti-friction bearings, totally enclosed gear drives. Special forming rolls for culvert pipe, stock tanks and other special shapes available.



MODEL 9-I
INITIAL PINCH TYPE ROLL

SLIP ROLLS
UP TO 8 GAUGE PLATE

Let Speed PAY-The WEBB Way!

SLIP ROLLS

PYRAMID TYPE ROLL

INITIAL TYPE ROLL

STEELWORKERS

Also Manufacturers of INDUSTRIAL WEIGHING EQUIPMENT

SLIP ROLLS

A complete line of small Sheet Metal Forming Rolls are also available. All power-driven with shaft sizes 3" to 5" for the handling of the thinnest gauge material, up to 8 gauge material. Special rolls for the forming of polished sheets, aluminum and stainless steels can be furnished. Complete catalogues on any size machine furnished upon request; write Dept. C.

Since 1881 **THE WEBB CORP.**
WEBB CITY, MO., U. S. A.

For More Information Circle No. 68 on Reader Service Card.

AN OXYGEN CUTTING MACHINE WEIGHING ONLY **13 POUNDS**

It's the new Messer QUICKY—
Lightweight BUT Heavy Duty

INEXPENSIVE • VERSATILE • PORTABLE

Find out now about the astounding 13 pound *Quicky* cutting machine—a marvel of welding engineering.

You'll be amazed at the quality of this machine—and even more amazed at its low, LOW price.

Cuts plate efficiently with acetylene, propane, or natural gas—thicknesses from ⅛ to 2½ inches.

GET FULL DETAILS QUICK ON THE QUICKY! Send information card now or write us direct for FREE BOOKLET.

MESSER CUTTING MACHINES, INC.

WELDING ENGINEERING Messer SINCE 1898

CHRYSLER BLDG., 405 LEXINGTON AVE., N. Y. 17

Circle No. 41 on Reader Service Card.

REFERENCE DATA

catalogs, handbooks, manuals

PORTABLE SEMI-AUTOMATIC WELDING SYSTEM is described in illustrated, six-page, two color brochure available from Reid-Avery Co., Inc. Literature explains how the Raco Dynaweld system lays down high quality welds continuously without gas shielding or water cooling. Specifications, production cost advantages and applications, are given. **For More Information Circle No. 75 on Reader Service Card.**

PRECISION SHAVING AND FINISHING of steel, stainless steel, titanium, aluminum, aluminum in aircraft, missile, industrial applications is the subject of illustrated Catalog 17, a four-pager published by Zephyr Manufacturing Co., Inc. Specifications and applications are given for two Weld Shaver models. **For More Information Circle No. 76 on Reader Service Card.**

FLUX-CORED ELECTRODES and semi-automatic wire feed equipment for welding of mild and alloy steels are described in a four-page bulletin and instruction manual available from Arcos Corp. Bulletin describes features, specifications and basic operating principles of the Arcosarc process CO_2 welding. **For More Information Circle No. 77 on Reader Service Card.**

A NEW MEMBER OF THE K-G FAMILY, a complete line of tungsten welding electrodes, is the subject of an information-packed four-page catalog prepared by the K-G Equipment Co., Inc. Literature describes the "electronic" difference, finishes, sizes, specs, and lists capacities and prices. **For More Information Circle No. 78 on Reader Service Card.**

DEPENDABLE, ACCURATE AND SPEEDY is the way a folder from Sury Engineering & Sales Co. describes a new pipe marking tool. Sketches illustrate how the inexpensive tool can eliminate the cost of hundreds of layout templates in making pipe joints, such as 90° lateral or an off-set saddle. **For More Information Circle No. 79 on Reader Service Card.**

TWO NEW RESISTANCE WELDERS, one an air-operated press-type spot welder, SPT-2, the other an air operated press projection welder, EPT-2, are fully described in an eight-page brochure prepared by Sciaky Bros., Inc. Dimensional drawings, illustrations and machine data tabulated to indicate KVA range, throat depths, welding capacities, and electrode forces, is included. **For More Information Circle No. 80 on Reader Service Card.**

A SEALED, WATER-COOLED IGNITRON, a product of the Electronic Components Div., General Electric, is the subject of four-page illustrated literature. Highly useful electrical and mechanical technical information is given for the 900 amp AC control along with performance curves. **For More Information Circle No. 81 on Reader Service Card.**

"A NEW CONCEPT in projection weld fasteners" is the way Parker-Kalon Division describes their Rimguard weld screws in literature. It explains how screw head rim limits the amount of pressure that can be applied during fusion, assures proper seating, minimizes flash and spatter; and controls quality and costs. **For More Information Circle No. 82 on Reader Service Card.**

For More Information Circle No. 31 on Reader Service Card. —

Weld anywhere with P&H portable welders!

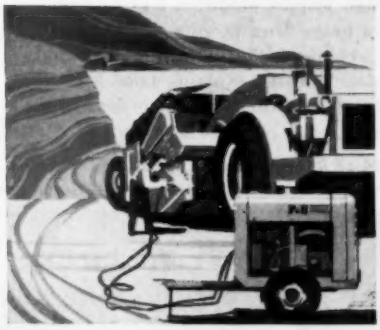
5 engine-driven models enable you to match your needs for construction, pipeline, maintenance, and repair welding in the 25- to 500-amp range

If you use portable welders, you haven't looked at the field until you've seen the new, broad P&H line. Five different models give you a wide choice of sizes to meet your needs and your pocketbook. Easy, precise voltage control and superior current and arc stability enable operators to lay down sounder, cleaner welds faster — prevent burn-through and popouts. The results: fewer rewelds and no costly call-backs.

The rugged, compact P&H welders are built to withstand the heavy use and rough handling on field jobs. They need less care — and they are easier to service. Powerful engines deliver power to spare — with gas-miser economy. A dependable idling control automatically slows the engine down to idling speed when not welding — saves gas and oil, cuts wear.

P&H engine-driven welders come skid- or wheel-mounted — with manual or 6-volt electric starting. For information, write Dept. Harnischfeger Corp., Milwaukee 46, Wis.

P&H HARNISCHFEGER
WELDERS · ELECTRODES · POSITIONERS



HERE ARE THE FIVE P&H SIZES!

WN-180
Handy, low-cost DC welder for shop and field work in the 25- to 200-amp range.

WNG-200
Compact, light-weight portable for heavy-duty DC welding ranging from 40 to 250 amps.

WNG-300
This rugged middleweight answers your need for trouble-free welding in the 60- to 375-amp class.

WNG-400
Here's cost-cutting DC weld power for the big jobs requiring 80 to 500 amps.

WND-303
This is a diesel-powered newcomer to the P&H line. Unit has a welding range of 60 to 375 amps.

RESISTANCE WELDING ELECTRODES, rods, bars, wheels, castings, forgings, holders and adapters, are the subject of a comprehensive catalog by Tipaloy Inc. Complete information is included on what alloys to use for what applications, standard and special electrodes and how to get more for your electrode dollar.

Circle No. 62 on Reader Service Card.

REGULATORS FOR THREE HOSE CUTTING TORCHES are described in Catalog Form #16 available from National Welding Equipment Company. Covered are the construction and operating features of the Triplex Safety Regulator Model 5-121, its specifications, applications and advantages.

Circle No. 83 on Reader Service Card.

HOW TO GET A LOWER WELD COST even though the electrode you select costs more is explained in a recent bulletin published by Metal & Thermit Corporation. Facts and figures cited prove that Speedex Triplex modified E-6027 electrodes with extra heavy iron powder coating can turn out heavy weldments costing less than with cheaper electrodes. Bulletin explains how X-ray quality welds can be made with either drag or open-arc techniques.

Circle No. 84 on Reader Service Card.

"UNIFORMITY OF ALLOY for rejection-free results" is the way United Wire and Supply Corporation describes their Phoson and Sil Bond brazing alloys in literature. The reason for it, they say, is the homogenizing treatment used during manufacture. Literature explains the availability of these alloys in coils, straight lengths and preformed rings in various wire diameters, where to use them, and how.

Circle No. 64 on Reader Service Card.

"HANDBOOK FOR WELDING Low Alloy High Tensile Steels" is a valuable reference published by Alloy Rods Company. It tells where to use Atom Arc iron powder low hydrogen electrodes and how to make X-ray quality welds with them.

Circle No. 85 on Reader Service Card.

"AC ARC WELDER combines the most modern engineering features with a super heavy duty transformer, providing these important benefits . . ." Then the bulletin, available from Marquette Manufacturing Co., Inc., goes on to describe Fibre-Glass cabinet construction; the extra-wide welding range; the high open circuit voltage; the large fan blade; the internally fused capacitor; and the close adherence to NEMA standards during the manufacture of the Series 94 welders.

Circle No. 86 on Reader Service Card.

Mrs. Mildred Fisher of John H. Fisher, General Welding, Wilmington, Delaware finds Manganal Bare easy to use to make the strongest welds faster. Manganal Bare has no coating; leaves no slag; eliminates chipping. Workhardens to 550 Brinell; tensile strength 150,000 psi. It is 100% metal; the most effective and economical electrode to use for reclamation welding. The proof is really in the use of Manganal Bare. Try it and see for yourself.

MEMBER NATIONAL WELDING EQUIPMENT ASSOCIATION

SOLE PRODUCERS **STULZ-SICKLES CO.**

929 JULIA STREET • ELIZABETH, N. J.

WRITE FOR COMPLETE DETAILS AND NEAREST DISTRIBUTOR

For More Information Circle No. 56 on Reader Service Card.

BATEMAN BANTAM IRON WORKER

THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch....$375.00
Shear only $495.00
Shipping wt. 750 lbs.

BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

Circle No. 12 on Reader Service Card.

ELECTRODE HOLDERS manufactured by The Fibre-Metal Products Co. are the subject of their bulletin No. 65. The bulletin illustrates and describes holder designs, functions and advantages. The bulletin lists all models with specifications for each.

Circle No. 87 on Reader Service Card.

A BULLETIN crammed with extremely useful information on portable cord and cable is available from Whitney Blake Company. Of special interest to welding users are the construction, specifications, diameters and electrical characteristic tables on Neoprene-covered and synthetic rubber-covered are welding cable.

Circle No. 88 on Reader Service Card.

REVOLVING CUP GUARDS are the subject of a detailed bulletin put out by Morrison Products Inc. How these guards, which revolve with the grinding wheel, provide lightweight safety through strength, for every application, is explained.

Circle No. 89 on Reader Service Card.

CARBON... for motor or generator applications . . . for welding electrodes and welder brushes . . . as extrusions, molded shapes and specials . . . all are clearly described in fact-filled Bulletin 59 from Becker Brothers Carbon Co. Bulletin also explains the no-obligation, always available engineering service.

Circle No. 90 on Reader Service Card.

HANDLING, INSTALLING and servicing ignitrons is the subject of a 31-page publication available from the General Electric Co. The publication describes and illustrates the different types of circuits and ignitron specification with each. Both ignitron and resistance welding do's and don'ts are listed.

Circle No. 91 on Reader Service Card.

TUNGSTEN ELECTRODES are the subject of a bulletin issued by the Sylvania Electric Products Inc. Described and illustrated are four electrodes types: Puretung, Zirtung, 2% Thoriated and 1% Thoriated.

Circle No. 57 on Reader Service Card.

POWER...PRECISION
SPECIFY
DE-STA-CO
TOGGLE CLAMPS
FOR QUALITY, TOO!

De-Sta-Co "Tiny Toggles" are ¾" high, 2¾" long when closed. Many different bases. U and solid work-holding bars. Ideal for light gauge welded assemblies where space is at a premium.

International Conveyor built this fixture to produce over a hundred 18′ wheeled conveyor fixtures on which automobile frames are assembled. The 7″ H-beams are brought to bear properly during welding, even sprung to fit, by six De-Sta-Co Model 558 Clamps developing over 2500 lbs. pressure. The completed conveyor line assembly fixtures also employ De-Sta-Co Toggle Clamps.

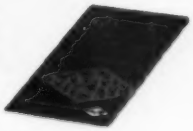
If your holding problems are at the opposite extreme, there's a group of "Tiny Toggles" only ¾" high but packing 42 lbs. of pressure. This is just an indication of the range you'll find in the De-Sta-Co line of over 130 models, types and sizes for every conceivable fast-action parts holding job. Welders predominantly specify our portable plier clamps. A broad selection of spindle accessories makes it easy to fit any clamp to your job. Along with this versatility, notice the quality features, such as plastic grips, cadmium plating, hardened bushings and serrated pivot pins, as you might expect of the originators of production speed-clamping devices.

Send for new catalog showing many clamp applications, dimension drawings and mechanical data. Ask for the name of the De-Sta-Co stocking distributor in your area.

Portable Clamps

Angular-Bar Type

Air-Operated Type



DE-STA-CO
Originators of Production Clamping

De-Sta-Co is widely known for toggle clamps, stampings, precision washers, spacers, shims, shim and feeler stock, blower housings and marine specialties.

DETROIT STAMPING COMPANY
324 MIDLAND AVENUE • DETROIT 3, MICHIGAN

For More Information Circle No. 17 on Reader Service Card.

ELECTRIC-ARC

One of a Series on Applications of Electric Arc's Smith-Dolan Units — Today's Most Versatile Heat-Treating Tools.

STOP WELD FAILURE with the SMITH-DOLAN SYSTEM of Low-Frequency Induction Heating

Here is the versatile heat-treating tool you need for producing sound welds easily and economically in carbo-alloy and other types of steel pipe . . . here is precision control of heating cycle when pre-heating and stress relieving — uniform, through-and-through heating of solid sections up to two feet thick and more — pushbutton operation — complete portability for on-the-job heat treating anywhere.

Many Money-Saving Applications — The Smith-Dolan System simplifies and upgrades work quality in numerous applications ranging from welding to forming and annealing. Units are available for 60 cycle heating in capacities ranging from 10 to 150 KVA . . . for 400 cycle heating . . . resistance heating. Pre-engineered with complete instrumentation, accessories.

"On Trial" Installations on Rental Basis — Prove the many Smith-Dolan advantages in your own plant without capital investment. Write, wire or phone.

Electronic recording gives permanent charts of heat run on this standard Smith-Dolan model. Coils permit work at 50 feet or more from unit. Eye hooks provide for easy handling by crane. Products ranging from a fraction of an inch to 10 feet in diameter can be heat treated on the job.

New Brochure — Send today for your copy of "Smith-Dolan System of Low-Frequency Induction Heating."

Electric Arc, inc.

152-2 JELLIFF AVENUE, NEWARK 8, N. J. Bigelow 3-3211

Representatives in Principal Cities

For More Information Circle No. 21 on Reader Service Card.

USEFUL LITERATURE *continued*

RECEPTACLES AND PLUGS are the subject of literature from Empire Products, Inc. Bulletin Number 301 describes Cam-Lok's complete line of receptacles and plugs. It lists many sizes and designs, and gives the standard and special purpose use in power distribution.

Circle No. 92 on Reader Service Card.

CHIPPING HAMMERS are featured in a data sheet issued by the Atlas Welding Accessories, Inc. The data sheet describes and illustrates Atlas's 33 models.

Circle No. 11 on Reader Service Card.

BARE WELDING ELECTRODES marketed by Stulz-Sickles Co. are described in a new catalog sheet. Featured is technical data on the Manganal Bare electrode. Information is given on tensile strength, work hardenability and uses in the field.

Circle No. 56 on Reader Service Card.

GLOVES AND GARMENTS for industrial use are featured in literature from the John Tillman & Co. Gloves and garments made of Brazilian deerskin are described.

Circle No. 61 on Reader Service Card.

PORTABLE STUD WELDER marketed by Graham Manufacturing Corp. is the subject of a two-color engineering data sheet. The data sheet describes the company's Super Six portable welder and tells how and where it is used.

Circle No. 93 on Reader Service Card.

FLUX RECOVERY SYSTEMS marketed by Invincible Vacuum Cleaner Mfg. Co., are the subject of a bulletin. Described and illustrated are the many ways you can save money in reclaiming flux on submerged arc welding jobs.

Circle No. 94 on Reader Service Card.

SURFACE HARDENING and heat treating compounds are the subject of a 6-page folder available from the Kasenit Co. The folder explains the usage of these compounds as to the how and why. The folder also

gives a heat coloring chart when tempering various type tools.

Circle No. 95 on Reader Service Card.

SPECIALIZED 25-PAGE SURVEY on 50 important design features used in 19 leading makes of oxy-acetylene welding and cutting equipment and industrial regulators is offered by Modern Engineering Company.

Circle No. 96 on Reader Service Card.

UNDERHUNG SINGLE BRIDGE motor-driven cranes are described in well-documented Bulletin DH-227-B issued by Wright Hoist Division, American Chain & Cable Co., Inc. Featured is the Type B-516 crane. Construction details, including weights and dimensions, are presented in easy-to-read tabular form.

Circle No. 97 on Reader Service Card.

WELDING DESIGN INFORMATION is now available in a handy 8-page brochure offered by Nadco Engineering Co., welding engineering consultants. Included are weld stress formulas and recommended joints for shielded metal arc and inert-gas metal arc welding.

Circle No. 98 on Reader Service Card.

A HIGH FREQUENCY HEATING unit that can be used for brazing, soldering and assorted heat treating operations is the subject of a catalog from Lepel High Frequency Laboratories, Inc. Described and illustrated is the company's 2 KW portable bench model.

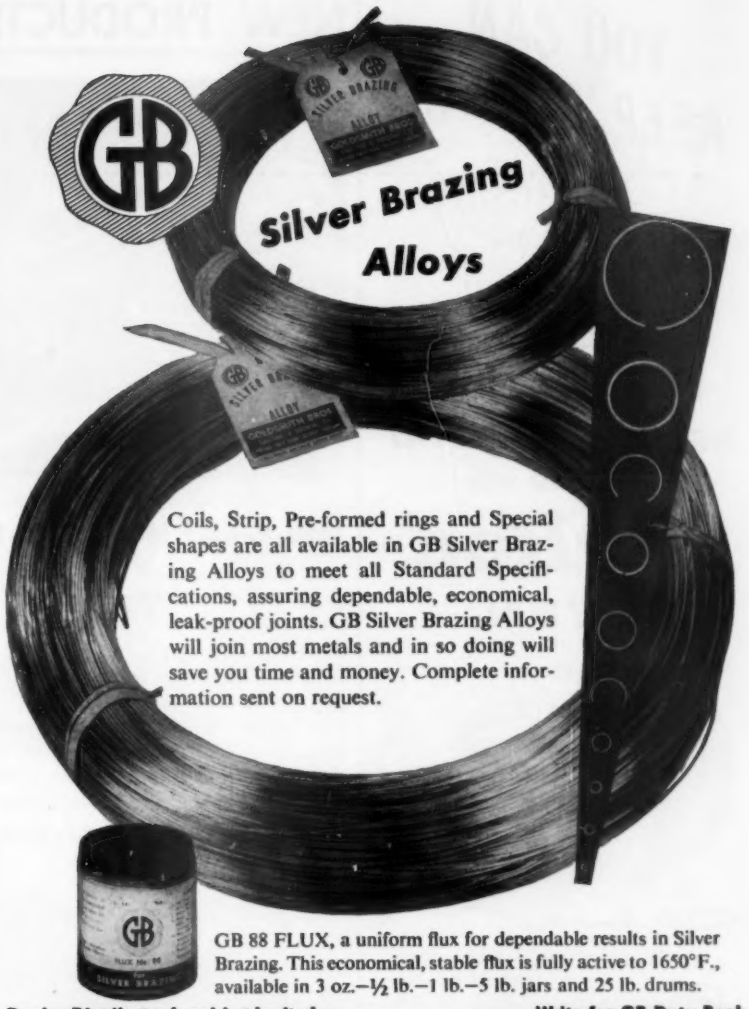
Circle No. 99 on Reader Service Card.

CUTTING AND NIBBLING shears are featured in a bulletin offered by Cosa Corp. This illustrated bulletin gives complete description and specifications on the Trumpf cut out and nibbling shears, and the copy nibbling machine.

Circle No. 100 on Reader Service Card.

BENCH MODEL TURNTABLE POSITIONER manufactured by Superior Welding Co. is the subject of literature available. Design details and operating instructions are given.

Circle No. 101 on Reader Service Card.


Silver Brazing
Alloys
Coils, Strip, Pre-formed rings and Special shapes are all available in GB Silver Brazing Alloys to meet all Standard Specifications, assuring dependable, economical, leak-proof joints. GB Silver Brazing Alloys will join most metals and in so doing will save you time and money. Complete information sent on request.

GB 88 FLUX, a uniform flux for dependable results in Silver Brazing. This economical, stable flux is fully active to 1650°F., available in 3 oz.–½ lb.–1 lb.–5 lb. jars and 25 lb. drums.

Dealer Distributor Inquiries Invited **Write for GB Data Book**

Goldsmith Bros. SMELTING & REFINING CO. Est. 1867

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HAVE YOU INVESTIGATED THE POSSIBILITIES OF LOWERING YOUR METAL JOINING COSTS BY SWITCHING TO SILVER BRAZING ALLOY ?

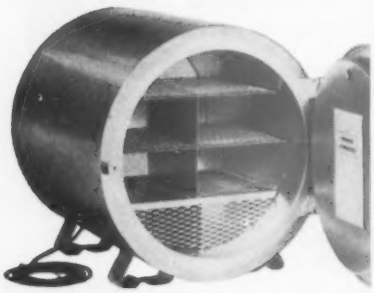
For More Information Circle No. 28 on Reader Service Card.

YOU CAN KEEP 'EM DRY

FOR 14c A DAY

Moisture-proof your electrodes at low cost with

DryRod® OVEN



Fourteen cents worth of electricity per day — that's about all it takes to operate the popular, Type 300 DryRod electrode oven. At that rate, and its low purchase price, you can't afford to be without DryRod protection against moist mineral coated rods. Insure your electrode investment against:

- POROSITY • UNDER-BEAD CRACKING
- ROUGH WELDS • ROD SCRAP LOSS
- REJECTS • REWORKS
- PRODUCTION SLOWDOWN

NEW! 800° or 1000° HIGH TEMPERATURE Re-baking Oven now available

The DryRod line of ovens now includes four basic models to meet every welding requirement.

Write for new folder "DryRod as Standard Welding Equipment".

PHOENIX PRODUCTS COMPANY
4731 N. 27th St. • Milwaukee 9, Wis.
Circle No. 47 on Reader Service Card.

NEW PRODUCTS

Tube Bender Makes Two 90° Bends In 1½ Seconds

A new, high-speed tube bending machine with two independent bending heads has been introduced by Costello Engineering Company. Called Double Header, the unit will make bends two at a time or singly. For bending two at a time, the length between centers of the bend radii is adjustable from 7- to 28-inches. Each bend angle is independently adjustable from 0 to 100 degrees. The machine bends any size steel tube up to ¾-inch diameter O.D.

Loading, bending and unloading is said to be all done in one smooth motion; operator never has to release the tube.

Dies are made of hardened and ground steel. Both standard and special die sizes are available.

For More Information Circle No. 105 on Reader Service Card.

Ultrasonic Welder

A new instrument-type ultrasonic welder designed to make welds in small parts and delicate assemblies has been developed by Aeroprojects. Unit has a power capacity of 100 watts. It is called Sonoweld Model W-100-TSL-58-6.

Circle No. 106 on Reader Service Card.

Inert Arc Starting

Split second, positive arc starting for inert arc spotwelding or cutting is a new development of Linde Company, Division of Union Carbide Corp. The new pilot-arc starter eliminates erratic firing from a cold electrode, typical when high frequency starting is used. Electrodes are said to last four times longer than with high frequency. Contamination problems are avoided.

The new method keeps the cup filled with incandescent gas, ready to fire the arc as soon as potential is applied. A 5-amp current plays between electrode and nozzle; shielding gas flow protects the electrode while pilot is on.

Circle No. 107 on Reader Service Card.

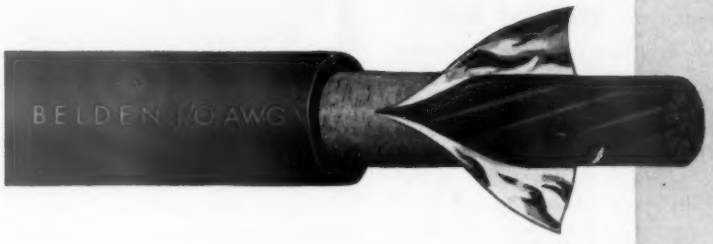
New Acetylene Fittings

Western Enterprises, Inc., manufacturer of brass fittings for the welding trade, announces three new additions to their adaptor line.

Adaptor #321 adapts "MC" tank to P.O.L. acetylene regulator; Adaptor #322 adapts "MC" tank to commercial acetylene regulator; and Adaptor #324 adapts "MC" tank to P.O.L. acetylene regulator.

Circle No. 108 on Reader Service Card.

Belden Welding Cable
the Complete Line



O.T.R. Rubber-Jacketed Cables
Oil-tempered rubber gives the best balance between easy handling, flexibility, and resistance to the effects of oil, heat, cold, and mechanical abuse.

Neoprene-Jacketed Cables
Resist oil, grease, heat, sunlight, mechanical abuse, and ozone set up by high frequency welding or atmospheric conditions.

HVF Vinyl Plastic-Jacketed Cables
High voltage-frequency vinyl insulation affords perfect resistance to corona and ozone cracking . . makes this cable ideal for high frequency welding. High resistance to abrasion, oil, and impact.

Whip Lead Cables
Hawser lay construction of conductor makes this cable extremely limp and manageable . . minimizes operator fatigue. Jacket won't pull away from electrode holder. Neoprene insulation.

plus rubber-jacketed welder power supply cords

ask your welding supply distributor

one wire source for everything electrical and electronic

magnet wire • lead wire • power supply cords • cord sets • portable cordage • electronic wire • automotive replacement wire and cable • aircraft wire • electrical household replacement cords

Belden
WIREMAKER FOR INDUSTRY
SINCE 1902
CHICAGO

18-1-9

For More Information Circle No. 14 on Reader Service Card.

New Cut-Off Saw

A new cut-off saw capable of length accuracy and cut parallelism within 0.003" with an unskilled operator is announced by Navan Products, Inc., North American Aviation Subsidiary.

The new saw's spindle and vise are integral parts of a single casting. Special machining and checking methods permit final alignment of cut to within 0.001" in all planes of the cutting operation. Long research of rpm and blade materials has resulted in a capability to cut accurately most ferrous and non-ferrous metals, plastic, and wood. It is said that this is done with the use of only two different blades and a fixed rpm.

Circle No. 131 on Reader Service Card.

Goggle Respirator

The new "Drednaut" announced by American Optical features a one-piece, mask-like goggle respirator combination molded from flexible rubber. An internally molded ridge separates the goggle section from the respirator section. A double facial seal results which stops exhaled air from reaching the goggle section.

The respirator section features a twin cartridge combination. Available are cartridges and filters for protection against dusts, mists, fumes, gases, sprays, vapors, insecticides, radioactive particulate matter of combinations of these hazards.

Circle No. 132 on Reader Service Card.

Liquid Oxygen Truck

A new 2,100 gallon truck (gaseous equivalent: 234,000 SCF) featuring high ratio of payload to gross vehicle weight has been announced by the Cambridge Corp. Liqua-Guard Model 2100L features an all-aluminum vacuum-jacketed tank and plastic-reinforced cab and body trim. Transport is equipped with two power take-off driven pumps: one for filling high pressure cylinders, the other for transferring liquid oxygen.

Circle No. 133 on Reader Service Card.

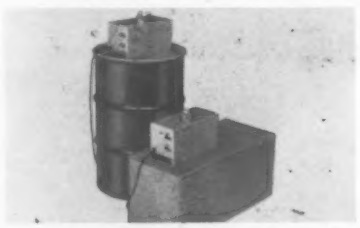
Projection Welding Nuts

Now available from the MacLean-Fogg Lock Nut Co. are two new projection weld nuts. The pilot and recessed-type nuts are available with the "Two-Way" locking feature which provides a lock in the middle of the nut rather than at the ends. A lock is assured even if the bolt only goes part way through the bolt.

The pilot weld nut eliminates the need for jigs or special locating fixtures; they automatically locate themselves in holes punched in the subassembly.

The recessed weld nut has a recess around the hole to eliminate weld flow or spatter; no retapping is needed.

Circle No. 134 on Reader Service Card.



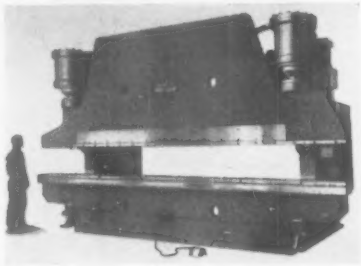
Equipment Cooler

A new line of cooler-circulators announced by the Bernard Welding Equipment Co. is designed to cool inert arc torches, automatic welding equipment, spot and induction welding equipment and welding fixture back-up bars.

The coolers are light-weight and compact. The model 400 (above) is a self-contained package containing the motor, a bronze-stainless gear pump, by-pass pressure control valve, visible flow indicator and an optional remote control relay. The unit has a capacity of 6 qts./min. at 20-100 psi. It weighs only 37 lbs.

The Model 400 unit is available mounted on standard 55 or 30-gallon drum lids, or 55- or 30-gallon drums or on 10- 22- or 40-gallon rectangular tanks.

Circle No. 109 on Reader Service Card.



20-Ft. Press Brake

The longest Steelweld hydraulic press brake built to date, a 20-foot by 5/16-inch mild steel plate capacity machine, has just been completed by The Cleveland Crane & Engineering Co.

The ram is driven by two hydraulic cylinders and kept level electronically. It can be tapered, or reversed at any point in the stroke.

The machine features flexibility: Ram travel can be quickly adjusted to speed repetitive operations; approach and return portion of stroke can be fast, pressing portion slow. Stroke length is 14-inches for the 500-ton machine.

Circle No. 135 on Reader Service Card.

Motorized Rheostat

A new motorized rheostat designed primarily for automatic inert gas welding of special metals has been developed by the Harnischfeger Corporation. The control is said to eliminate thermal shock at the beginning of the weld, and cracking at the finish of the weld.

The rate of change for upslope from a present minimum starting to a preset welding current, and subsequently, a down slope from the welding current to a preset minimum current is controlled by means of two separate rheostats that control the speed of the motor driving the current control rheostat.

This unit may be used with any P & H unit using remote contactor control and remote rheostat current control.

This unit has a timer for timed weld operation. The selection switch set for timed weld, encompasses only the time of full welding current. The

upslope and decay slope times are not included, but can be incorporated if so desired.

The maximum speed of upslope and down slope is about four seconds. The minimum speed of up slope and down slope is about 25 seconds.

Circle No. 110 on Reader Service Card.

Air Mover

A simple and efficient device, designed to exhaust welding fumes, smoke and hot air from closed work areas is being marketed by Arcair Company.

The Air Mover is connected to the shop air line and positioned at an opening of a vessel being welded. Acting like a venturi, it draws off smoke and fumes, draws in fresh air. The operating noise level is low.

Circle No. 111 on Reader Service Card.

Abrasive Cutting Coolant

A deodorant-containing coolant for use with all makes of abrasive cutting machines and many grinders has been announced by the Allison-Campbell Division, American Chain & Cable Co., Inc. Called Campbellene, the product is said to keep wheels clean and sharp, speed chip settling, improve cut quality, minimize odors and inhibit machine rusting. Product has long-lasting effectiveness, won't support bacteria or turn rancid and won't foam, according to Allison.

Circle No. 112 on Reader Service Card.

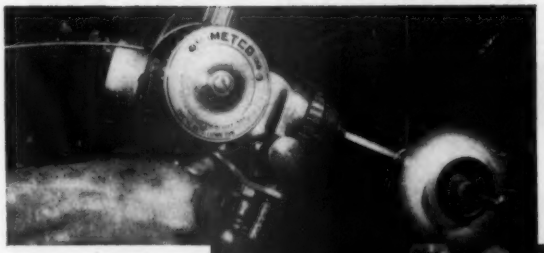
Thick-Joint Aluminum Pipe

The Reynolds Metals Company has announced the availability of H-E pipe in a complete range of Schedule 40 equivalent sizes in addition to the already available Schedule 80 equivalent sizes.

Feature of the 30 to 40-foot long aluminum pipe: thick joints for strength—tapering into walls to free them of excess metal. Heavy-End pipe is interchangeable with standard aluminum pipe.

Circle No. 113 on Reader Service Card.

Complete your shop with this modern metallizing installation



WIRE GUN
Sprays any metal that can be drawn into wire form.

POWDER GUN
Sprays hard-facing alloys and ceramics in powder form.

Without metallizing no maintenance or "job" shop can offer the same complete service as the shop that uses industry's low-cost "putting-on" tool.

With modern, low-cost metallizing equipment you can spray carbon steels, stainless, babbitts, brass, bronze, nickel, aluminum, tin, zinc, special hard facing alloys including tungsten carbide.

- **Save up to 90% of replacement costs on machine repair jobs**
- **Do your own hard-facing at high speed, low cost**
- **Apply long-wearing, corrosion-resistant coatings**

A real opportunity for the smaller shop

Thousands of large, well-known companies and shops have been metallizing users for many years, not only in maintenance work but in production applications on original equipment. Now, with modern low-cost metallizing equipment this high-speed "putting-on" tool is within the reach of even the smallest shop.

FREE BULLETIN

Send off the coupon for detailed information — find out how a metallizing installation can pay for itself in a very short time. No obligation, of course.

Metallizing Engineering Co., Inc.
1179 Prospect Ave., Westbury, L. I., New York

Please send me free bulletin on metallizing.

Name _____

Title _____

Company _____

Address _____

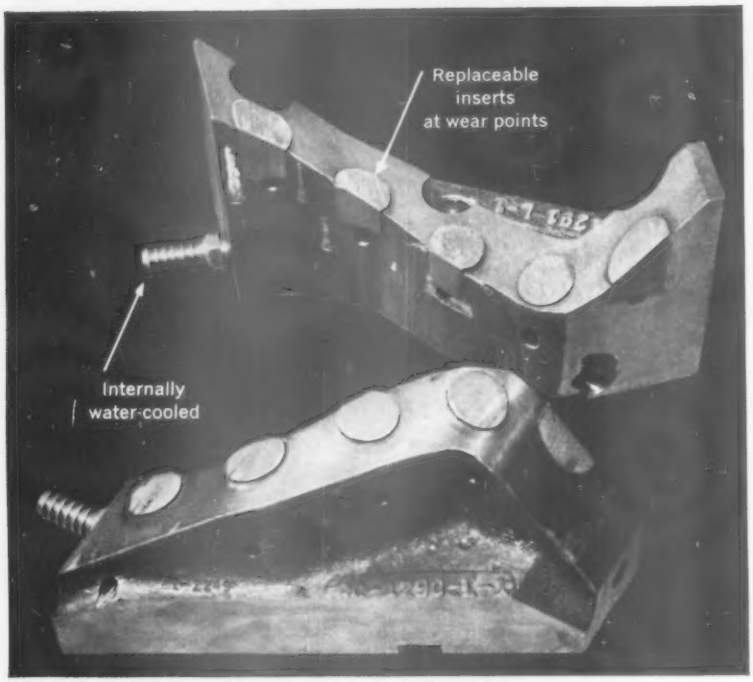
City _____ Zone _____ State _____

Metallizing Engineering Co., Inc.
1179 Prospect Ave., Westbury, L. I., New York · cable: METCO
In Great Britain: Telephone: EDGEWOOD 4-1300
METALLIZING EQUIPMENT COMPANY, LTD.—Chobham near Woking, England

For More Information Circle No. 42 on Reader Service Card.

AMPCO®

7 times longer life for projection welding die!



Replacement time and cost reduced almost 75%!

Originally, the projection welding die shown here was cast to contour in one piece and not internally water-cooled. Its life was short. Replacement was expensive, in terms of both money and downtime.

Then Ampco's experience was drawn upon. Working surfaces were changed to incorporate relatively inexpensive refractory inserts which could be quickly replaced. Adequate water-cooling was provided, also. These two factors vastly increased die life.

Ampco has complete facilities and the know-how for making welding dies of all types — flash, butt, projection, and cross-wire. Your Ampco-Weld distributor can put them to work for you. Call him. Write for Bulletin RW-10.

RW-28

AMPCO METAL, INC., Dept. 177 H, Milwaukee 46, Wis.

West Coast Plant: Burbank, California • Southwest Plant: Garland (Dallas County), Texas

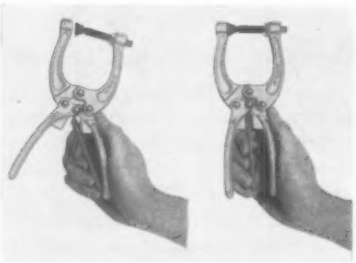
For More Information Circle No. 8 on Reader Service Card.

AC/DC Welder

A new 250 amp AC-DC transformer-rectifier type welder has been developed by Miller Electric Mfg. Co., Inc. The Big Twin machine has AC ranges of 20-125 and 60-290; DC spreads are 18-100 and 65-290. Rated output for both AC and DC is 250 amps at 30v on 40% duty cycle or 200 amps at 40v on 60% duty cycle.

Big Twin operates from single phase service, has infinite current adjustments with its movable shunt-type transformer. It has a semi-metallic rectifier stack.

Circle No. 114 on Reader Service Card.



Portable Plier Clamp

The new De-Sta-Co. Model 462 clamp incorporates a patented two-way trigger release for simple one-hand operation.

Designed for clamping operations in hard-to-reach positions the new clamp comes in a variety of sizes with jaw openings to 6-inches and holding pressure capacities to 1200 pounds.

Circle No. 115 on Reader Service Card.

Semi-Automatic Process

An improved semi-automatic process for welding mild steels up to 75,000 psi tensile strength offers several important advantages over manual welding with stick electrodes, according to the Arcos Corporation.

The Arcosarc process uses a flux-

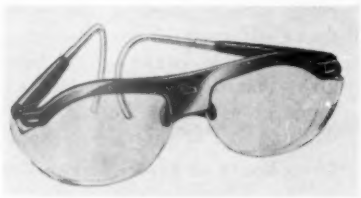
cored electrode continuously fed into the weld puddle where it is shielded by CO_2 gas. With are visible the operator can guide and control the speed of welding.

The Arcosarc combination of a specific flux, selected deoxidizing agents and CO-2 shielding is said to produce a weld deposit with excellent ductility even at low temperatures.

This process is suitable for circumferential welds done in the "three o'clock" position.

The equipment consists of a welding gun and semi-automatic wire feed equipment. It can be connected to most welding machines of 500 ampere AC-DC capacity or larger. Drooping characteristic DC machines are recommended.

Circle No. 116 on Redaer Service Card.



Comfortable Goggles

New, smooth, pink plastic temple hooks have been adopted as standard ear pieces on all "Tuc-Away" goggles manufactured by Watchemoket Optical Company, Inc. These new hooks slide in and out of the temples for easy adjustment by the wearer. Once adjusted, they hold firmly in place.

The Retrax feature and Tuc-Away's universal nose bridge makes it possible to stock one size goggle and fit all workers quickly and perfectly.

Tuc-Away goggles also feature optically correct, interchangeable heavy impact lenses which snap in and out of the frame for easy replacement by the wearer.

Circle No. 117 on Reader Service Card.

Clean Hands Station

A dispenser loaded with Vilan paste-type hand cleaner features easy, push-button, wasteless operation. Marketed by Dameron Enterprises, Inc., dispenser installs easily without fasteners. It holds 96 ounces of cleaner.

Circle No. 118 on Reader Service Card.

Here, in one compact bulletin, is the information that can help you choose the right cylinders for transporting and distributing all types of high-pressure gases—including oxygen, nitrogen, argon, ethylene and carbon dioxide.

Here, too, are related the facts that show why *deep drawn* high-pressure gas cylinders are most likely to save you money on shipping charges, handling costs and maintenance.

Complete data are given—showing styles, sizes, capacities of cylinders, and ICC specifications which Hackney cylinders far exceed.

Whether you serve industrial or medical customers, you ought to have this new bulletin handy as a guide to quality and as an aid in ordering your Hackney cylinders.

mail the coupon today!

Pressed Steel Tank Company
1473 S. 66th Street
Milwaukee 14, Wisconsin

Gentlemen: Please send the new bulletin at once. We are interested in facts and prices of Hackney high-pressure gas cylinders for ☐ industrial, ☐ medical service; in quantities 1 to 24 ☐, 25 to 99 ☐, 100 to 499 ☐, 500 to 999 ☐, 1000 or more ☐.

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Pressed Steel Tank Company
Manufacturer of Hackney Products Since 1902
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CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS
For More Information Circle No. 48 on Reader Service Card.

For More Information Circle No. 25 on Reader Service Card.

Flood FIBER GLASS WELDING HELMETS
For Safety, Comfort and Economy

These seamless fiber glass units (of thermo-setting, polyester resin) are compression-molded and stoutly reinforced to afford maximum protection. All are fitted with the new Fit-Rite, snap on, ratchet type headgear—the most comfortable, durable and easiest-to-maintain you can buy, and not more expensive.

NEW DESIGN ADVANTAGES

1. Lighter weight for more comfort.
2. A smoother and stronger shell.
3. Easier cleaning and sterilizing.
4. Non-warping moisture-proof construction.
5. Superior resistance to heat.

No. 51-8F-2H

No. 53-8F-2H

No. 51-2F-2H

Enjoy real savings with Flood's
1000-HOUR COVER LENS
Outlasts 125 glass lenses. Reduces eye fatigue. Safer because shatter-proof.

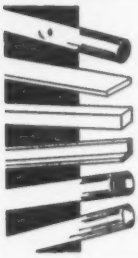
No. 53-2F-2H

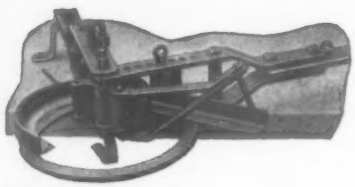
See Your Distributor or Write:

Flood Always FINEST QUALITY FAIRLY PRICED
FLOOD SAFETY PRODUCTS CO.
3037 WEST LAKE STREET, CHICAGO 12, ILLINOIS

1 MAN + 1 BENDER

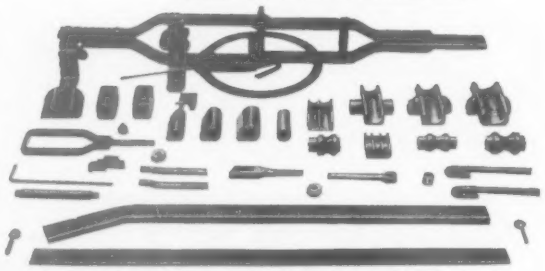
Bends all these:


ROUNDS
FLATS
SQUARES
ANGLE IRON
PIPE
TUBING & CONDUIT



HOSSFELD
UNIVERSAL® IRON BENDER
35 Years Bending Experience

- Wrenchless, ready to use.
- Practical, quickly set up.
- Adaptable, replaces special equipment.
- Versatile, 147 different dies available.
- Dependable, a "must" for maintenance, limited production.
- Invaluable, optional equipment makes jobs easier.


BENDER SHOWN WITH REGULAR EQUIPMENT

FREE: WRITE FOR BULLETIN

HOSSFELD MFG. CO.
436 W. THIRD STREET • WINONA, MINNESOTA

For More Information Circle No. 33 on Reader Service Card.

Fume Exhaust System

A new low-cost, high-efficiency exhaust system for welding shops has been developed by Car-Mon Products, Inc. The Tab-L-Exhauster system pulls out all welding fumes from their source. Receptor exhaust inlets with magnetic bases hold fast, right on the weldment or on any convenient metal nearby, eliminating the need for bulky counterbalances. Powerful suction from a fan system draws off gases, fumes, smoke and heat. Flexible, weld-proof tubing gives maneuverability and a wide range of usefulness from a fan exhausting one or several receptors.

Circle No. 15 on Reader Service Card.

New Arc Welders

A new line of eight horizontal-type "Sureweld" electric arc welders in the low- and medium-price range is announced by the National Cylinder Gas Division of Chemetron Corporation.

It is said that the compact new AC and AC-DC welders feature comparatively high open-circuit voltages which give easy arc striking, excellent arc stability and faster and easier welding.

All models operate from single-phase AC current. The new AC models provide welding current ranges of 20 to 295 amperes and a DC range from 18 to 290 amperes.

Circle No. 119 on Reader Service Card.

Pipe Marking Tool

A new tool manufactured by the Sury Engineering & Sales Co. is said to make pipe marking simple and easy.

The tool is said to eliminate mistakes and prevent lost time when marking off angle laterals and headers. The tool is said to eliminate need for calculation.

Circle No. 120 on Reader Service Card.

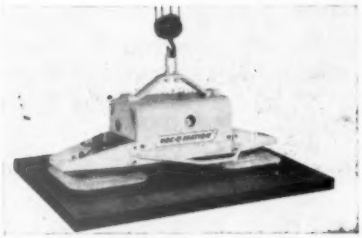
Portable Safety Shield

A new portable safety shield for welding, grinding and other manufacturing operations has been introduced by Singer Glove Mfg. Co. It features a heavy-duty olive drab duck curtain treated with UL-approved flame-resistant finish and is guaranteed water- and mildew-resistant. The curtain snaps around the metal frame and is secured by heavy-duty rust-proof snap fasteners.

The frame is made of heavy tubular steel and steel connecting rods in rust-proof black oxide finish.

The Shield comes in four standard sizes.

Circle No. 121 on Reader Service Card.



Structural Shape Cutter

The structural shape cutter manufactured by Stefan Manufacturing Corp. is said to greatly reduce handling, layout and cutting time on structural shapes such as I-beams, H-beams, angles, channels, bars, and plates. Two independently operated variable-speed motors activate the horizontal and vertical geared tracks, insuring a smooth, steady cut.

Constant heat is achieved by solenoid valves which coordinate the gas and oxygen at the burning tip. An adjustable dial can be set to allow smooth, mitered or straight cuts.

Structural shapes are handled easily on roller conveyor. Cutters are available in 24-, 36-, and 48-inch sizes.

Circle No. 122 on Reader Service Card.

For More Information Circle No. 37 on Reader Service Card.

ANNOUNCING A

NEW METHOD OF CONNECTING WELDING CABLE

T.P.C.* PAT. PENDING

*THREADED POWER CONNECTION

Trim insulation — allow ¼" to extend through sleeve

Slip on threaded sleeve

Crimp sleeve with Swedg-on tool

ASK YOUR HI-AMP DISTRIBUTOR TO EXPLAIN THIS NEW-EASILY ATTACHED-COOL RUNNING CONNECTION

LENCO, Inc. P.O. Box 189 Jackson, Mo.

MODERN, STRATEGIC DEFENSE PLANNING . . . WELSH WELDERS' FLASH SPECTACLES!

Protects against impact, light or flash hazards where a completely enclosed, cup type, safety goggle is not required.

Lenses meet all Federal specifications . . . are made of heat treated glass.

Style 3261
Sturdy, precision-made, metal frame spectacles with solid plastic or leather side shields.

Style 2050
Rugged, comfortable butyrate frame spectacles with solid or perforated side shields.

WELSH MANUFACTURING COMPANY
9 MAGNOLIA STREET, PROVIDENCE, R. I.

WELSH — Willingly Worn By Workers Everywhere

For More Information Circle No. 70 on Reader Service Card.

For More Information Circle No. 15 on Reader Service Card.

OUT GO WELDING FUMES

Right from the Source

(Pat. Pending)

CAR-MON DUAL TAB-L-EXHAUSTER

assures "on-the-spot" efficiency with powerful suction in magnet-base receptor

Newest development by CAR-MON, specialist in carbon monoxide removal for garages and repair shops . . .

Lifetime magnet-base holds exhaust receptor fast on work or nearby metal. No bulky counterbalances needed. Flexible tubing gives full, easy maneuverability. Car-Mon's simple installation thoroughly exhausts gases, smoke and heat . . . gives practical, low-cost air cleaning for any shop layout.

Write for full details and catalog.

CAR-MON PRODUCTS, INC.
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LOOKING FOR THE BEST? Buy INDEPENDENT Acetylene Cylinders

Unconditional Guarantee
Proven Filler - No "Spitting"
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Alloy shells for Lighter Weight
Cylinder Shells - Meet all ICC Requirements
All Cylinders "WHEELABRATOR" cleaned
Standard Sizes in Stock - Special Sizes on Request

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INDEPENDENT ENGINEERING COMPANY, Inc.
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CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE · OXYGEN · NITROGEN · ARGON
O'FALLON 2, ILLINOIS

For More Information Circle No. 34 on Reader Service Card.

Liquid Fluxing

An improved liquid flux and a new dispenser have been announced by The Sight Feed Generator Co.

Liquiflux automatically goes into gas stream of any welding torch and into the flame. It leaves no residue. Its uses: ferrous and nonferrous brazing and to improve action of silver solder flux.

The Liquifluxer dispenser features constant flux flow without use of wicks, no shutdowns for flux refill and separate valves for obtaining the exact amount of flux needed.

Circle No. 123 on Reader Service Card.

New Goggle Package

The manufacturers of Eyegard safety goggles, American Industrial Safety Equipment Co., Inc., have developed a new package for their product as an aid to both users and distributors.

Colorful outside package holds 12 individually boxed goggles. By tearing off perforated end, well indentified inside boxes are easily counted and removed.

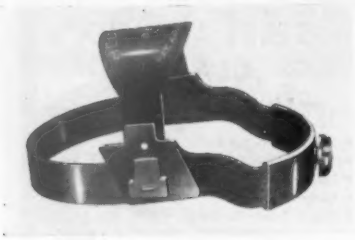
Circle No. 124 on Reader Service Card.

Stud Welding Gun

A new stud welding gun claimed to be the smallest and lightest made has been introduced by Shielded Stud Welding Co. Pistol-size Model R will

handle studs through ½-inch base diameter.

Circle No. 125 on Reader Service Card.



New Headgear

The new Hed-Rite Headgear manufactured by the Chicago Eye Shield Co. adjusts three ways: for head size; for overall strap length and for overhead strap position.

Unique headband design has the proper combination of curves and opposing cambers to produce the broad contacts necessary for complete comfort.

The new headgear can be worn with any face shield, helmet, hood or goggle equipped with Cesco X-14 brackets.

Circle No. 126 on Reader Service Card.

Plastic Welding Rod

A close tolerance and porosity-free rod is packaged by Laramy Products Co. in tubes containing 2½, 5 and 25 pounds of material. Three diameters (1/8-, 5/32- and 3/16-inch) are carried in stock in 48-inch straight length for the welding of Types I and II PVC. Linear Polyethylene rod is available in ⅛-inch only.

Circle No. 127 on Reader Service Card.

Gap Press With Roll Feed

Federal Machine and Welders 60-ton capacity welded steel, open back single crank, flywheel-type gap press operates at 75 to 200 strokes per minute. It features bronze-lined crank and gibways, flywheel antifriction bearings, air counter-balance for slide, recirculating lubricating system, rotary limit switch and pneumatic clutch and brake.

Feed is a double roll type for .060-inch material, 12-inches wide. Feed length is zero to 12-inches. Maximum feeding speed is 1200 IPM.

Circle No. 128 on Reader Service Card.

For More Information Circle No. 63 on Reader Service Card.

New TUFFALOY MUCH IMPROVED Tip Holders

For long life and ease of maintenance, TUFFALOY Series "E" straight ejector-type holders combine top performance with great simplicity of design.

The entire sturdy brass head, with its attached ejector tube, is forced into the barrel to eject the welding tip. Two rubber water seals prevent leakage. They are placed inside the barrel, hidden from dirt and damage. This design eliminates the small, easily distorted ejector plunger extending through the stationary head of most holders now on the market.

A threaded coupling holds head and barrel together, and permits the head to swivel freely. Loosen the coupling, even without removal from the machine, for inspection and maintenance.

Made in twelve models: barrels are 8″ and 12″ long, 1″, 1¼″ and 1½″ diameter, and hold No. 1 and No. 2 Morse taper tips in threaded adapters, furnished as part of each holder. Adapters are RWMA class 2 alloy to reduce wear of the tip socket.

TUFFALOY Resistance Welding Alloys are widely available through AIRCO and TUFFALOY representatives. Call on them for Spotwelding Tips (Standard, TUFFCAP, Cold-Bent, and Special), Holders and Adapters, Bar Stock, Forgings, Seam Welding Wheels, and all other welding alloy needs. Ask for Catalog and Price List.

AIRCO

AIR REDUCTION SALES COMPANY
A Division of Air Reduction Co., Inc.
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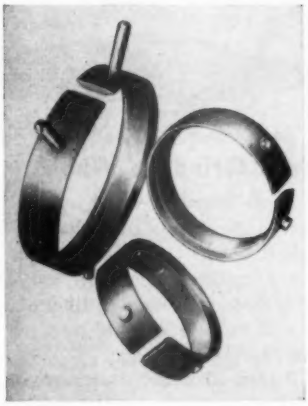

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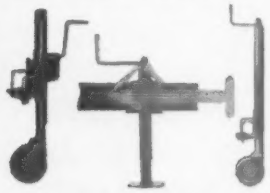

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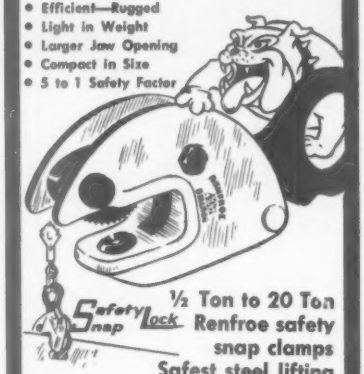

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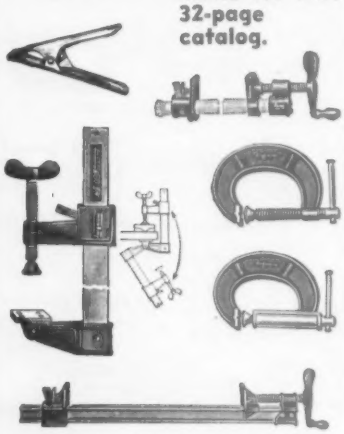

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ADVERTISERS' INDEX

for August, 1959

Acorn Iron & Supply Co. 46
Adjustable Clamp Co. 72
Air Reduction Sales Co. 5
All-State Welding Alloys Co., Inc. 46
American Brass Company ..... Inside Back Cover
American Chain & Cable Co., Page Steel & Wire Division 25
American Optical Company 15
American Pullmax Co. 39
Ampco Metal, Inc. 64
Anti-Borax Compound Co., Inc. 71
Aronson Machine Company 2
Atlas Welding Accessories, Inc. 14
Bateman Foundry & Machine Co. 56
Becker Bros. Carbon Company 70
Belden Mfg. Company 61
Car-Mon Products 68
Cincinnati Tool Co. 71
Detroit Stamping Co. 57
Duro Engineering Co. 23
Eastman Kodak Company 45
Eisler Engineering Co. 72
Electric Arc, Inc. 58
Eutectic Welding Alloys Corp. 41
Evans Rule Company 39
Flood Safety Products Co. 66
Ford Steel Company 50
General Ceramics Corp. 51
Goldsmith Bros. Smelting & Refg. Co. 59
Hammer Blow Tool Company 70
Handy & Harman 24
Harnischfeger Corp. 55
Hobart Brothers Co. 1
Hossfeld Manufacturing Co. 66
Independent Engineering Co. 68
Jackson Product ..... Inside Front Cover
Johnston & Funk Metallurgical Corp. 49
Lenco, Inc. 67
Lincoln Electric Co. 8-9
Linde Company, Division of Union Carbide Corporation 17
Marquette Mfg. Company, Inc. 4
Messer Cutting Machines, Inc. 54
Metallizing Engineering Co. 63
Miller Electric Mfg. Co. 26
Norton Company 18-19
Page Steel & Wire Division, American Chain & Cable Co. 25
Phoenix Products Co. 60
Pressed Steel Tank Co. 65
Rankin Mfg. Company 16
J. C. Renfroe & Sons, Inc. 70
Robvon Backing Ring Co. 69
Ruemelin Mfg. Company 72
S-M-S Corporation 49
Singer Glove Mfg. Co. 71
Smith Welding Equipment Corp. 11
Stulz-Sickles Company 56
Sylvania Electric Products, Inc. 20
Taylor-Wharton Company 52
Tec Torch Company 48
Thermacote Company 72
John Tillman & Company 71
Tipaloy, Inc. 40
Tuffaloy Department, Air Reduction Sales Co. 69
United Wire & Supply Corp. 50
Vickers, Inc., Electric Products Division 13
Victor Equipment Co. 22
Vogel Tool & Die Corp. 51
Webb Corporation 53
Welded Truck & Specialty Co. 71
Welsh Manufacturing Co. 67

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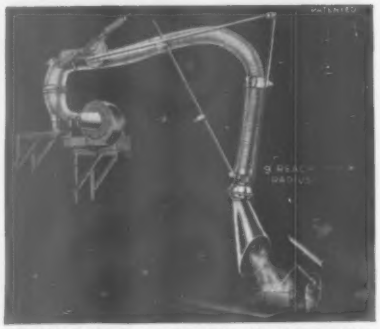

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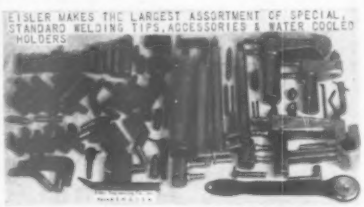

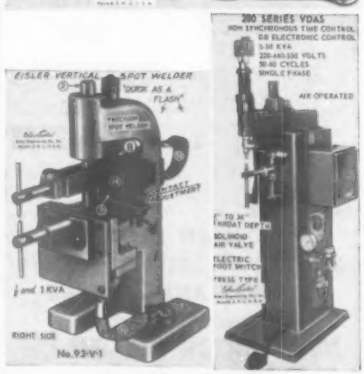

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